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ABSTRACT

This curriculum guide was designed for use in postsecondary appliance repair education programs in Georgia. Its purpose is to provide for development of entry level skills in appliance repair in the areas of knowledge, theoretical structure, tool usage, diagnostic ability, related supportive skills, and occupational survival skills. The first section of six explains the philosophies, purposes, and goals of vocational education in Georgia. Section 2 presents employability skills related to the occupational area of appliance repair, specific occupational titles, student exit points, and tasks cross referenced to the Dictionary of Occupational Titles. Section 3, the largest part of the guide, provides unit guides for each task. (For each task, a task description, student performance objective, suggested instructional activities, instructional materials, evaluation section, and suggested instruction hours are included.) Section 4 contains the curriculum structure and course outline, while student record forms and competency certificates make up section 5. The last unit contains facility guidelines, with drawings, for group instruction and individualized instruction facilities. Appendixes to the guide contain references and resources, information on teaching special needs students, and definitions of terms. (KC)

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APPLIANCE REPAIR

Post Secondary

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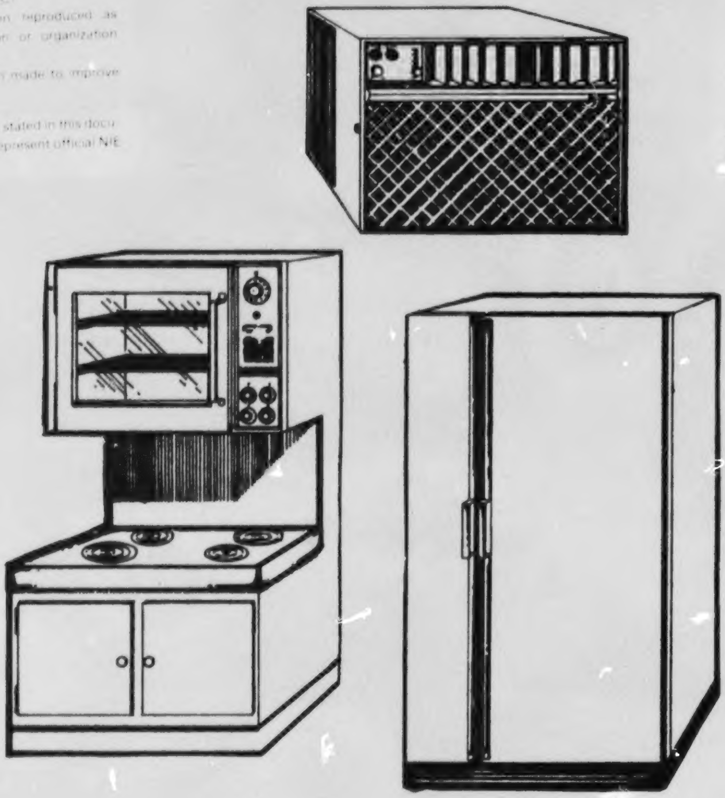

CE 032 062

CURRICULUM GUIDE

Georgia Department of Education

APPLIANCE REPAIR

Developed Under Contractual Agreement with

Division of Program Development
Office of Vocational Education
Georgia Department of Education
Atlanta, Georgia 30334
Charles McDaniel, State Superintendent of Schools
1981

APPLIANCE REPAIR

Developed By
The University of Georgia

Under the Direction of
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POLICIES AND PROCEDURES FOR THE CENTER

PURPOSE OF THE CENTER

The Vocational Education Materials Center functions within the division of Vocational Education, University of Georgia. This Center operates under grants from the U.S. Office of Education, and the Georgia State Department of Education with the support of the College of Education. The Center is comprehensive in its commitment and approach to the development and dissemination of materials in the broad field of Vocational Education.

The purpose of the Center is to increase the capability of Georgia's delivery system for Vocational Education. Specifically, the Center is committed to:

1. Develop materials to assist in the implementation of proposed curricula and to enhance the teaching Vocational Education.

2. Conduct and report curriculum research related to Vocational Education.

3. Provide a production and dissemination center to Vocational Education materials.

4. Provide direct experiences in curriculum development and diffusion for advanced graduate stduents.

5. Enable faculty members to participate in the development and implementation of a variety of curriculum materials.

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PURPOSE AND UTILIZATION OF THE CURRICULUM GUIDES

The purpose of this curriculum guide is to provide a suggested model for organizing vocational instructional content. In many cases, more material is available than may be needed, there fore, an instructor will need to adapt the content to meet his/her program needs.

While the guide is primarily oriented towards the classroom, whether as a primary resource or as a supplement to other teaching materials; it may also assist administrators, counselors and lay people involved in local school systems. The following outline provides an overview of the various ways these groups may utilize the curriculum guides.

a) Vocational teachers.

1. Provide a guide for organizing their program of instruction,
2. Assist in establishing program objectives,
3. Serve as a curriculum materials resource guide,
4. Improve communications with employers and advisory committees
5. Facilitate competency based instruction,
6. Facilitate either group or self-paced instruction,
7. Include content by quarter and semester,
8. Cross-reference with existing state developed instructional materials (PLACE packages and post secondary I.I.).

b) Vocational supervisors and administrators.

1. Assist in defining the scope and content of their programs,
2. Provide a means to improve curriculum management functions,
3. Serve as a guide for admissions and job placement functions,
4. Improve communications with employers and advisory committees.

c) Counseling and guidance staff.

1. Provide a data base for counseling and guidance personnel,
2. Identify student exit points (Career Options),
3. Serve as guide for admissions and job placement,

4. Correlate with new State Board of Education graduation requirements,
5. Provide specific content sequencing by quarter and semester for student scheduling,
6. Provide (a) curriculum options for the disadvantaged handicapped student, (b) curriculum modifications for SPECIAL NEEDS students, (c) typical admission requirements for regular and SPECIAL NEEDS students.

(d) Local Curriculum Coordination Committees.

1. Serve as a guide in working out articulation arrangements,
2. Improve definitions of the relationship between secondary clusters and post secondary specialized programs.

Vocational teachers, supervisors and administrators, counseling and guidance staff and local curriculum coordination committees will be primary users of this guide, however, the use of the guide is not limited to these groups, but by any and all groups directly related in designing a vocational curriculum.

-Foreword-

It has been the privilege of the Division of Vocational Education, University of Georgia, to participate in the development of 48 curriculum guides for Georgia vocational education programs. This work was sponsored by the Division of Program Development, Office of Vocational Education, State Department of Education. The completion of these guides meets a long standing need to provide a comprehensive curriculum overview of the vocational education programs available in Georgia schools. This developmental activity involved one of the largest professional staffs ever assembled for such work. Numerous teachers, teacher educators and state staff members have either written parts of the guides or served on the field review teams. These professionals were supported by a myriad of technical people and a host of typists who literally worked from dawn to dusk to ensure that the guides were produced in a timely fashion.

Be assured that this guide is not intended to be your curriculum or the curriculum of any school. The purpose of this project staff, and I am sure of the state OVE staff, is to offer a guide with supporting resources and teaching ideas from which the vocational instructor can extract a curriculum that meets local needs. The guide, however, does simplify curriculum decisions concerning sequencing and the selection of resources and media support.

The Task Linkage Project and appropriate V'TECS catalogs were used as the beginning point for this guide and all of the others. To assure that these task listings were directly related to Georgia vocational education programs and industry, they were subjected to additional study and review by appropriate teachers.

At some point in the future, this guide will need to be revised. To ensure that such a revision truly reflects the needs of Georgia's vocational education programs, the developers need your reactions, comments and ideas. We will also be interested in how you use this guide. Let us hear from you.

Paul Scott
Curriculum Guide Projects I & II

SECTION I

PHILOSOPHY, PURPOSE & OBJECTIVES

SECTION I

Section I Content List

State Philosophy and Goals
Local Philosophy and Goals

Section I provides an overview of the philosophies, purposes and goals for vocational education in the State of Georgia. These are applied to vocational education at the postsecondary level, however, it is recognized that more specific philosophies, purposes and goals will be applicable depending on the character of the local program.

VOCATIONAL EDUCATION IN GEORGIA

A. PHILCSOPHY

The Georgia Board of Education perceives vocational education as a vital component in the education of the young and adult citizens of this State. Appropriate programs of vocational education and ancillary services should be made readily available to individuals in middle schools, vocational divisions of junior colleges, vocational centers, the Quick Start program and other adult programs designed to train or retrain workers for useful and satisfying employment.

Special services and assistance must be provided to those who need it in order to participate or benefit from vocational education. This includes women, minorities, the displaced homemaker and other displaced workers, those with limited English-speaking ability, the disadvantaged and the handicapped.

Since men and women spend the greater part of their lives at some form of work, the State should provide opportunities for all its citizens to develop the knowledge, skills and attitudes necessary for them to secure personally satisfying and socially useful employment.

B. PURPOSE

The purpose of vocational education shall be to improve the economic well-being of Georgia citizens by preparing individuals, through organized learning experiences, to select, obtain and advance in recognized occupations.

POSTSECONDARY VOCATIONAL EDUCATION

A. PURPOSE

The purpose of postsecondary vocational-technical education in Georgia is to improve the economic well-being of adult citizens by providing access to high quality vocational-technical training for skilled and semi-skilled occupations, for improvement of existing skills or for retraining in a new occupation.

B. OBJECTIVES

1. To provide vocational-technical education programs and ancillary services commensurate with the needs and interests of students and available job opportunities.

2. To provide vocational-technical education programs which are current with the state-of-the-art, competency-based, and offer multiple exit points to accommodate the students' occupational objectives.

3. To provide vocational-technical education programs which are articulated with available high school counterparts, to facilitate an easy transition from secondary to postsecondary levels without loss of credit.

4. To provide vocational-technical education programs such that 75% of those individuals who leave or complete a program of occupational preparation will find employment in the field, or a related field, for which trained.

5. To provide those guidance, counseling, financial aid, evaluative, job placement, remedial and other supportive programs and services needed by students to enroll, complete a program and become, or remain, employable in a skilled or semi-skilled occupation.

6. To provide needed assistance to special populations to include women, minorities, limited English-speaking, the displaced homemaker and other displaced workers, the disadvantaged and the handicapped.

7. To provide vocational-technical education programs for full-time and part-time students on campus during the day as well as the evening hours, and to provide appropriate programs for full-time and part-time students off campus in businesses and industries, comprehensive high schools and other locations within the respective schools' service areas.

8. To serve as a center for the delivery of postsecondary and adult vocational-technical education programs and services for the community and assigned service area.

STATEMENT OF LOCAL SYSTEM PHILOSOPHY, PURPOSE AND OBJECTIVES FOR VOCATIONAL EDUCATION

(This page is intentionally left blank so that local systems may insert their copy of philosophy, purpose and goals for vocational education.)

SECTION II

PROGRAM DESCRIPTION & RELATED INFORMATION

SECTION II

Section II Content List

Employability Skills
Appliance Repair Occupational Description
Appliance Repair Program Objective
Definition of the D.O.T. Code
Description of Appliance Repair D.O.T.
Task Listing by D.O.T. Code

The major goal of vocational education in Georgia is to prepare individuals, through organized learning experiences, to select, obtain and advance in recognized occupations. Section II provides an overview of employability skills that are desirable in any occupation and relates their significance to the specific occupational area of Appliance Repair.

The Appliance Repair Program Objective contains the specific occupational titles. These occupational titles are further explained in the description of the occupational exit points and task listing. The concentration of the program is based on these tasks.

EMPLOYABILITY SKILLS

Employability skills exert a great deal of influence on a person's ability to get and keep a job. Surveys indicate that more people lose their jobs because of poor attitudes toward their job than for lack of job skills. For this reason it is important that information concerning the following employability skills be provided as an ongoing part of the program.

1. Getting a job
    - a. Filling out job applications
    - b. Developing a resume
    - c. Preparing for a job interview

2. Keeping a job
    - a. Be on time and regular in attendance
    - b. Maintain a fair share of the work-load
    - c. Work without supervision
    - d. Meet production schedules
    - e. Properly care for and use equipment
    - f. Dress appropriately for the job
    - g. Maintain good personal hygiene
    - h. Develop and maintain good communication with supervisors and co-workers

A recent study sponsored by the Illinois Department of Adult, Vocational and Technical Education and conducted by the University of Illinois, "Survival Skills: Mastering the Human Aspects of Work", has identified twelve topics that might be developed into instructional modules for teaching occupational survival skills. The author, Robert E. Nelson, outlines these topics listed below and on the next page, each followed by a general objective which indicates the relationship between the topic and the survival skills required to maintain a job.

*"1. Working in an Organization: To familiarize students with the reasons for the formation of organizations and the common characteristics of organizations.

2. Understanding Self and Others: To have students develop insights into causes of human behavior and learn to interpret their own behavior and the behavior of other.

3. Motivation for Work: To have students develop and understanding of motivations into the work they perform.
4. Interpersonal Relations: To have students develop concepts and skills in interpersonal relations and apply them to work situations.
5. On-the-Job Communication: To have students understand the importance of effective communication and learn ways of communicating effectively on the job.
6. Using Creativity on the Job: To make students aware of their creative potential and to practice using their creative ability in hypothetical on-the-job situations.
7. Authority and Responsibility: To have students develop an understanding of the concepts of authority, power, influence, and responsibility as they apply to work situations.
8. Problem Solving: To have students develop skill in applying problem solving to their work.
9. Coping with Organizational Change: To make students aware of the process of organizational change and the techniques for coping with organizational change.
10. Coping with Organizational Conflict: To make students aware of the sources and types of conflicts encountered on the job and recognize ways of coping with conflicts in an organization.
11. Leadership: To have students recognize the need for leadership in work groups and increase their understanding of the leadership role in work situations.
12. Adapting and Planning for the Future: To have students develop perspectives of work in the future and the ability to plan for anticipated changes in their work roles."

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*Abstracted from the article, "Survival Skills: Mastering the Human Aspects of Work," by Robert E. Nelson, *American Vocational Journal*, November 1977.

APPLIANCE REPAIR*

Nature of the Work

Major appliances usually are repaired in customer's homes by repairers who carry their tools and a number of commonly used parts with them.

To determine why an appliance is not working properly, repairers operate it to detect unusual noises, overheating or excess vibration. They look for common sources of trouble, such as faulty electrical connections. They may dissassemble the appliance to examine its parts.

After locating the trouble, the repairer makes the necessary repairs or replacements according to the type of appliance and defect involved. Repairers then operate the appliance after completing a repair to check their work.

Repairers may answer customer's questions and complaints about appliances and frequently advise them about the care and use of their appliance.

Repairers may estimate and collect the cost of repairs. They also keep records of parts used and hours worked on each job.

Working Conditions

Repair shops generally are quiet, well lighted, and adequately ventilated. Working conditions outside the shop vary. For example, repairers sometimes work in narrow spaces and uncomfortable positions amidst dirt and dust. Those who repair appliances in homes may spend several hours a day driving, although the use of 2-way radios has decreased this time.

Although the work generally is safe, repairers could have an accident while handling electrical parts and lifting and moving large appliances. Inexperienced workers are shown how to use tools safely and how to avoid electric shock.

Places of Employment

About 145,000 people were employed as appliance repairers in 1978, mostly in independent appliance stores and repair shops. Others worked for service centers operated by appliance manufacturers, department stores, wholesalers, and gas and electric utility companies.

Appliance repairers are employed in almost every community, but are concentrated in the more highly populated States and metropolitan areas.

Training, Other Qualifications, and Advancement

Formal training in appliance repair is available from some high schools and vocational schools. The programs in these schools provide the background in electrical and mechanical repair that is needed to enter this occupation. However, graduates usually receive additional training from their employers.

The type of training provided by employers varies among companies. Trainees work on different types of appliances. This process continues until they can repair a variety of appliances. Beginners may be trained by experienced repairers during house calls or while repairing in the shop situation. Up to 3 years of on-the-job training may be needed to become skilled in all aspects of repairing some of the more complex appliances.

To become familiar with new appliances and the proper ways to repair them experienced repairers attend training classes or view study manuals.

Persons who want to become repairers generally must have a high school diploma. Courses in electricity are essential because most repairs involve work with electrical equipment. Mechanical aptitude is also desirable. Appliance repairers who work in customer's homes must be able to get along with people.

Appliance repairers in large shops or service centers may be promoted to supervisor, assistant service manager, or service manager. A few may advance to managerial positions. Experienced repairers who have sufficient funds may open their won appliance store or repair shop.

Employment Outlook

Employment of appliance repairers is expected to grow about as fast as the average for all occupations through the 1980's. In addition to the jobs created by growth of this occupation, many openings will arise each year from the need to replace experienced repairers who retire, die or transfer to other occupations.

The number of appliances in use is expected to increase very rapidly as the number of households grows and new and improved appliances are introduced. Maintaining this large number of appliances will increase the need for qualified repairers.

Sources of Additional Information

For further information about jobs in the appliance service field, contact local appliance repair shops, appliance dealers and utility companies, or the local State employment service.

Information about training programs or work opportunities is also available from:

Association of Home Appliance Manufacturers
20 N. Wacker Drive
Chicago, IL 60606

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*Occupational Outlook Handbook, 1980 ed.

APPLIANCE REPAIR PROGRAM OBJECTIVE

Given appropriate instruction, as suggested by this guide, a student completing the program should demonstrate entry level skills in Appliance Repair in the areas of knowledge, theoretical structure, tool usage, diagnostic ability, related supportive skills and occupational survival skills.

As the student progresses through the program, sufficient competencies will be acquired to enable the student to enter the occupational field at the following D.O.T. Codes.*

Electrical Appliance Preparer	(D.O.T. Code 827.584-010)
Household Appliance Installer	(D.O.T. Code 827.661-010)
Electrical Appliance Servicer	(D.O.T. Code 827.261-010)
Gas-Appliance-Servicer Helper	(D.O.T. Code 637.684-010)
Gas-Appliance Servicer	(D.O.T. Code 637.261-018)
A/C Inst.-Servicer Helper, Window Unit	(D.O.T. Code 637.687-010)
A/C Installer-Servicer, Window Unit	(D.O.T. Code 637.261-010)
Gas Leak Tester	(D.O.T. Code 827.584-014)
Refrigeration Mechanic Helper	(D.O.T. Code 637.687-014)
Refrigerator Tester	(D.O.T. Code 827.384-010)
Refrigeration Unit Reparier	(D.O.T. Code 637.381-014)

*Dictionary of Occupational Title, 1977, ed.

DEFINITION OF D.O.T. CODE*

As a result of technological, economic and sociological influences, nearly every job in the economy is performed slightly differently from any other job. Every job is also similar to a number of other jobs. In order to look at the millions of jobs in an organized way, job titles are designated a 9-digit occupational code. Each set of three digits in the D.O.T. Code has a specific purpose or meaning that differentiates it from all other codes.

The first three digits of the D.O.T. Code identify a particular occupational group. In the code 652.382-010, the first digit indicates an occupational category. The second digit refers to a division within the occupational category. The third digit defines a specific occupational group within a division.

The middle three digits of the D.O.T. Code 652.382-010 are the worker function rating of the tasks performed in the occupation. Every job requires a worker to function, to some degree, in relation to data, people and things. A separate digit expresses the worker's relationship to each of these three groups. Worker functions involving more complex responsibility and judgment are assigned lower numbers while functions which are less complicated have high numbers.

The last three digits of the D.O.T. Code 652.382-010 indicate the alphabetical order of titles within 6-digit code groups. They serve to differentiate a particular occupation from all others. A number of occupations may have the same first six digits, but no two D.O.T. Code can have the same nine digits.

*Dictionary of Occupational Titles, 1977 ed.

DESCRIPTION OF OCCUPATIONAL EXIT POINTS*

827.584-010 ELECTRICAL-APPLIANCE PREPARER (any ind.) uncrater.

Assembles and tests electrical appliances, such as ranges, refrigerators, and washing machines, to prepare appliance for delivery and installation, using handtools and test lamp: Uncrates appliance parts, using screws and handtools. Connects appliance to electric current to test performance. Locates faulty tape to repair insulation. Washes and polishes appliances. Examines exterior of appliance for chips, scratches, and dents. Keeps records of appliances received, assembled and delivered. May be designated according to type of appliance assembled and tested as DISHWASHER PREPARE (any ind.); ELECTRIC-RANGE PREPARER (any ind.); ELECTRIC-REFRIGERATOR PREPARER (any ind.); WASHER-DRIER PREPARER (any ind.).

827.661-010 HOUSEHOLD-APPLIANCE INSTALLER (any ind.)

Installs household appliances, such as refrigerators, washing machines, stoves, and related appliances, in mobile homes or customers' homes, using handtools: Levels refrigerators using plumbing tools. Observes complete cycle of automatic washers and dryers and makes adjustments. Lights and adjusts pilot lights on gas stoves and examines valves and burners for prefabricated kitchen cabinets in conjunction with appliances. May stain or finish cabinets.

827.261-010 ELECTRICAL-APPLIANCE SERVICER (any ind.) appliance service representative

Installs, services, and repairs stoves, refrigerators, dishwashing machines, and other electrical household or commercial appliances, using handtools, test equipment, and following wiring diagrams and manufacturer's specifications: Connects appliance to power source and test meters, such as wattmeter, ammeter, or voltmeter. Observes readings on meters and graphic recorders. Examines appliance during operating cycle to detect excess vibration, overheating, fluid leaks, and loose parts. Disassembles appliance and examines mechanical and electrical parts. Traces electrical circuits, following diagram, and locates shorts and grounds, using ohmmeter. Calibrates timers, thermostats, and adjusts contact points. Cleans and washes parts, using wire brush, buffer, and solvent, to remove carbon, grease, and dust. Replaces worn or defective parts, such as switches, pumps, bearings, transmissions, belts, gears, blowers, and defective wiring. Repairers and adjusts appliance motors. Reassembles appliance, adjusts pulleys, and lubricates moving parts, using handtools and lubricating equipment. May be known according to appliance repaired as CLOTHES-DRIER REPAIRER (any ind.); COFFEE-MAKER SERVICER (any ind.); DISHWASHING-MACHINE REPAIRER (any ind.); ELECTRIC-RANGE SERVICER (any ind,); ELECTRIC-REFRIGERATOR SERVICER (any ind,); WASHING-MACHINE SERVICER (any ind.).

637.684-010 GAS-APPLIANCE-SERVICER HELPER (any ind.)
customer servicer helper; gas fitter helper.

Assists gas-appliance servicer in installing, testing, adjusting, and repairing regulators, ranges, and heaters, in customer's establishments: Transports tools, parts, equipment, and appliances from truck to customer's establishment, using handtruck. Measures, cuts, threads, and connects pipe to feeder line and installed appliance using pipe cutter, threader, and wrench. Dismantles appliances and replaces defective pipes, thermocouples, thermostats, valves, and spindles, using handtools. Performs other duties as described under helper (any ind.). May be designated according to kind of appliance repaired as GAS-STOVE-SERVICER HELPER (any ind.).

637.261-018 GAS-APPLIANCE SERVICER (any ind.) appliance servicer; customer servicer.

Installs and repairs gasmeters, regulators, ranges, heaters, and refrigerators in customer's establishment, using manometer, voltmeter, handtools, and pipe-threading tools: Measures, cuts, and threads pipe and connects it to feeder line and equipment or appliance, using rule, pipe cutter, threader, and wrench. Tests and examines pipelines and equipment to locate leaks and faulty pipe connections and to determine pressure and flow of gas, using manometer, voltmeter, combustible gas indicator, and soap lather. Dismantles meters and regulators, and replaces defective pipes, thermocouples, thermostats, valves and indicator spindles, using handtools. May assemble new or reconditioned appliances. May collect for monthly bills or overdue payments. May be designated according to appliance serviced as GAS-REFRIGERATOR SERVICER (any ind.); GAS-STOVE SERVICER (any ind.).

637.687-010 AIR-CONDITIONING INSTALLER-SERVICER HELPER, WINDOW UNIT (any ind.)

Assists air-conditioning installer-servicer, window unit in repairing, servicing, or installing window-mounted air-conditioning units, performing any combination of following duties: Carries unit from delivery vehicle to worksite. Assembles window-support brackets, using handtools. Cuts opening through wall for insertion of unit, using hammer and chisel. Applies calking compound to excess space between air-conditioner and wall opening. Performs other duties as described under helper.

637.261-010 AIR-CONDITIONING INSTALLER-SERVICER, WINDOW UNIT (any ind.)

Installs, services, and repairs air-conditioning units, ranging from 1/2 to 2 tons capacity, in private residences and small business establishments: Examines unit visually for defective parts, or listens to machine in operation, utilizing to determine cause of malfunction. Dismantles whole or part of machine, as indicated by type of malfunction, and repairs or replaces such parts as switches, relays, fan motors, thermostats, and other components, using handtools and power tools. Replaces filters, lubricates unit, and adjusts controls. Reassembles machine, making necessary adjustments to insure efficient operation. May estimate cost of repairs or adjustments. May remove machines from customer's premises for major repairs or overhaul in shop, or for return to manufacturer for extensive repairs. May repair sealed refrigeration units of machines.

827.584-014 GAS-LEAK TESTER (refrigeration equipment)

Performs one or more of following tasks to test assembled and charged refrigeration units for refrigerant leaks: Adjusts controls to set balance and range of electronic leak tester. Moves nozzle of tester along refrigerant lines, condenser, and compressor and listens for buzzer indicating presence of gas. Narrows range of tester and probes area to pinpoint exact location of leak. Turns valve of gas tester to adjust flow of gas to copper flame-ring, along surfaces of refrigeration unit and observes flame for change in color denoting presence of leaking refrigerant gas. Wraps wet litmus paper around joints of refrigeration unit and observes paper for color change indicating refrigerant leak. Marks number of defective part or joint on inspection tag, according to blueprint numbering chart, and attaches tag to unit. Records number and location of leaks on inspection chart.

637.687-014 REFRIGERATION-MECHANIC HELPER (any ind.)

Assists refrigeration mechanic in installing, maintaining, and repairing industrial and commercial refrigerating systems: Transports tools, materials, components, and refuse to and from work area. Lifts or holds parts while refrigeration mechanic fits, alines, and fastens them into position. Bolts or unbolts parts, using handtools. May cut and thread pipe to specified length, using pipe cutter, stock and die. May insulate cabinets and systems. Performs other duties as described under helper (any ind.).

827.384-010 REFRIGERATOR TESTER (refrigeration equipment)

Inspects and tests refrigeration units to evaluate functional operation of system, using knowledge of refrigeration systems and operating specifications: Connects unit to electrical outlet and starts compressor. Observes units to detect malfunction and insure that cooling is taking place. Tests compressors on non-functioning units for specified wattage, using watt-meter. Times operating cycle of unit, using watch and replaces relay switches, or orders compressor replacement to regulate length of operating cycle. Feels lines and other components at various points in system to determine if unit is functioning. Examines constriction or obstruction in lines. Records and attaches inspection tag to malfunctioning units, indicating type and location of defects. May attach gages to verify conformance of unit to temperature, pressure, B.T.U., and other operational specifications. May work in controlled temperature room.

637.381-014 REFRIGERATION UNIT REPAIRER (refrigeration equipment)

Replaces defective components and reassembles refrigeration units to work orders and blueprint specifications: Studies rejection slips from inspection department or customer's letters and observes functioning of components, such as controls, fan, condenser, evaporator, or compressor to determine need for repair or replacement. Drains oil and pumps gas from unit. Loosens bolts, and melts soldered or brazed seams, to dismantle unit, using handtools and torch. Removes and replaces defective components. Brazes or solders parts to repair defective joints and leaks. Reassembles unit, using measuring instruments, handtools, soldering iron, and hand torch. Routes defective components to salvage department. May adjust unit controls. Records cause of malfunction, repairs, and replacements made.

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*Dictionary of Occupational Titles, 1977 ed.

TASK LISTING BY D.O.T. CODE

In this section the occupational exit points from the curriculum are cross referenced with the tasks which are required for employment in each job title. On the line following each task an x appears in the column of each job title to which to task applies. All the tasks listed in this matrix are taught in the curriculum presented in this guide. A detailed treatment of each task appears in the Unit Guides section of this curriculum guide.

TASK LISTING BY DOT CODE

APPLIANCE REPAIR

	POSSIBLE EXIT POINTS DOT DESCRIPTION	Electrical-Appliance Preparer	Household-Appliance Installer	Electrical-Appliance Servicer	Gas-Appliance Servicer Helper	Gas-Appliance Servicer	A/C Inst.-Servicer Helper, Window Unit	A/C Installer-Servicer, Window Unit	Gas Leak Tester	Refrigeration Mechanic Helper	Refrigerator Tester	Refrigeration Unit Repairer	
	DOT NO.	827.584-010	827.661-010	827.261-010	637.684-010	637.261-018	637.687-010	637.261-010	827.584-014	637.687-014	827.384-010	637.381-014	
TASK NO.	TASK NAME												
REFRIGERATION													
	DUTY A: Refrigeration Fundamentals												
RF-01	Demonstrating a knowledge of the basic refrigeration concepts												
RF-02	Describing the function of the basic refrigeration cycle components												
RF-03	Using refrigeration tools												
RF-04	Drilling, tapping and threading												
RF-05	Identifying tubing and pipe fittings												

TASK LISTING BY DOT CODE

APPLIANCE REPAIR

POSSIBLE EXIT POINTS

	DOT DESCRIPTION	Electrical-Appliance Preparer	Household-Appliance Installer	Electrical-Appliance Servicer	Gas-Appliance Servicer Helper	Gas-Appliance Servicer	A/C Inst.-Servicer Helper, Window Unit	A/C Installer-Servicer, Window Unit	Gas Leak Tester	Refrigeration Mechanic Helper	Refrigerator Tester	Refrigeration Unit Repairer	
	DOT NO.	827.584-010	827.661-010	827.261-010	637.684-010	637.261-018	637.687-010	637.261-010	827.584-014	637.687-014	827.384-010	637.381-014	
TASK NO.	TASK NAME												
	DUTY B: Tubing and Pipe												
RF-06	Performing basic copper tubing operations												
RF-07	Soft soldering copper tubing												
RF-08	Silver brazing												
	DUTY C: Refrigerants												
RF-09	Handling refrigerants												
RF-10	Installing and using access valves												
RF-11	Maintaining refrigeration manifold gauges												

TASK LISTING BY DOT CODE

APPLIANCE REPAIR

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME DOT DESCRIPTION	Electrical-Appliance Preparer	Household-Appliance Installer	Electrical-Appliance Servicer	Gas-Appliance Servicer Helper	Gas-Appliance Servicer	A/C Inst.-Servicer Helper, Window Unit	A/C Installer-Servicer, Window Unit	Gas Leak Tester	Refrigeration Mechanic Helper	Refrigerator Tester	Refrigeration Unit Repairer	
	DOT NO.	827.584-010	827.661-010	827.261-010	637.684-010	637.261-018	637.687-010	637.261-010	827.584-014	637.687-014	827.384-010	637.381-014	
RF-12	Installing and using refrigeration manifold gauges												
RF-13	Evacuating a refrigeration system												
RF-14	Installing refrigeration accessories												
RF-15	Testing for leaks												
RF-16	Charging the system												
	DUTY D: Troubleshooting												
RF-17	Testing the compressor												
RF-18	Troubleshooting condensers												

TASK LISTING BY DOT CODE

APPLIANCE REPAIR

POSSIBLE EXIT POINTS

	DOT DESCRIPTION	Electrical-Appliance Preparer	Household-Appliance Installer	Electrical-Appliance Servicer	Gas-Appliance Servicer Helper	Gas-Appliance Servicer	A/C Inst.-Servicer Helper, Window Unit	A/C Installer-Servicer, Window Unit	Gas Leak Tester	Refrigeration Mechanic Helper	Refrigerator Tester	Refrigeration Unit Repairer	
	DOT NO.	827.584-010	827.661-010	827.261-010	637.684-010	637.261-018	637.687-010	637.261-010	827.584-014	637.687-014	827.384-010	637.381-014	
TASK NO.	TASK NAME												
RF-19	Troubleshooting evaporators												
RF-20	Troubleshooting automatic expansion valves												
RF-21	Troubleshooting capillary tubes												
RF-22	Troubleshooting thermostatic expansion valves												
RF-23	Troubleshooting the refrigeration system												
	DUTY E: Window Air Conditioning												
RF-24	Installing a window A/C unit												
RF-25	Performing pre-season start-up maintenance on												
	window A/C units												

TASK LISTING BY DOT CODE

APPLIANCE REPAIR

POSSIBLE EXIT POINTS

	DOT DESCRIPTION	Electrical-Appliance Preparer	Household-Appliance Installer	Electrical-Appliance Servicer	Gas-Appliance Servicer Helper	Gas-Appliance Servicer	A/C Inst.-Servicer Helper, Window Unit	A/C Installer-Servicer, Window Unit	Gas Leak Tester	Refrigeration Mechanic Helper	Refrigerator Tester	Refrigeration Unit Repairer	
	DOT NO.	827.584-010	827.661-010	827.261-010	637.684-010	637.261-018	637.687-010	637.261-010	827.584-014	637.687-014	827.384-010	637.381-014	
TASK NO.	TASK NAME												
RF-26	Troubleshooting compressor burnout in a window A/C												
RF-27	Evacuating and charging window A/C units												
RF-28	Troubleshooting fans and fan motors in window A/C units												
RF-29	Troubleshooting mechanical problems in window A/C refrigeration cycle												
RF-30	Troubleshooting window A/C electrical system												

TASK LISTING BY DOT CODE

APPLIANCE REPAIR

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	Electrical-Appliance Preparer	Household-Appliance Installer	Electrical-Appliance Servicer	Gas-Appliance Servicer Helper	Gas-Appliance Servicer	A/C Inst.-Servicer Helper, Window Unit	A/C Installer-Servicer, Window Unit	Gas Leak Tester	Refrigeration Mechanic Helper	Refrigerator Tester	Refrigeration Unit Repairer	
		827.584-010	827.661-010	827.261-010	637.684-010	637.261-018	637.687-010	637.261-010	827.584-014	637.687-014	827.384-010	637.381-014	
	DUTY F: Refrigerators and Freezers												
RF-31	Identifying and describing the function of the refrigeration components												
RF-32	Evacuating and charging domestic refrigerator and freezer systems												
RF-33	Testing and replacing the refrigeration cycle components												
RF-34	Troubleshooting refrigerator/freezer compressor burnout												

TASK LISTING BY DOT CODE

APPLIANCE REPAIR

POSSIBLE EXIT POINTS

	DOT DESCRIPTION	Electrical-Appliance Preparer	Household-Appliance Installer	Electrical-Appliance Servicer	Gas-Appliance Servicer Helper	Gas-Appliance Servicer	A/C Inst.-Servicer Helper, Window Unit	A/C Installer-Servicer, Window Unit	Gas Leak Tester	Refrigeration Mechanic Helper	Refrigerator Tester	Refrigeration Unit Repairer	
	DOT NO.	827.584-010	827.661-010	827.261-010	637.684-010	637.261-018	637.687-010	637.261-010	827.584-014	637.687-014	827.384-010	637.381-014	
TASK NO.	TASK NAME												
RF-35	Testing and replacing the refrigerator/freezer fans and fan motor												
RF-36	Diagnosing problems in refrigerators and freezers												

TASK LISTING BY DOT CODE

APPLIANCE REPAIR

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME \ DOT DESCRIPTION	Electrical-Appliance Preparer	Household-Appliance Installer	Electrical-Appliance Servicer	Gas-Appliance Servicer Helper	Gas-Appliance Servicer	A/C Inst.-Servicer Helper, Window Unit	A/C Installer-Servicer, Window Unit	Gas Leak Tester	Refrigeration Mechanic Helper	Refrigerator Tester	Refrigeration Unit Repairer	
	DOT NO.	827.584-010	827.661-010	827.261-010	637.684-010	637.261-018	637.687-010	637.261-010	827.584-014	637.687-014	827.384-010	637.381-014	
ELECTRICITY													
	DUTY A: Fundamentals												
EL-01	Identifying safe working conditions												
EL-02	Using basic electrical theory												
EL-03	Computing Ohm's law and power formulas												
EL-04	Using electric meters												
EL-05	Identifying electrical symbols												
EL-06	Drawing basic schematic diagrams												

TASK LISTING BY DOT CODE

APPLIANCE REPAIR

	POSSIBLE EXIT POINTS DOT DESCRIPTION	Electrical-Appliance Preparer	Household-Appliance Installer	Electrical-Appliance Servicer	Gas-Appliance Servicer Helper	Gas-Appliance Servicer	A/C Inst.-Servicer Helper, Window Unit	A/C Installer-Servicer, Window Unit	Gas Leak Tester	Refrigeration Mechanic Helper	Refrigerator Tester	Refrigeration Unit Repairer	
	DOT NO.	827.584-010	827.661-010	827.261-010	637.684-010	637.261-018	637.687-010	637.261-010	827.584-014	637.687-014	827.384-010	637.381-014	
TASK NO.	TASK NAME												
EL-07	Laying out and wiring series and parallel circuits												
EL-08	Reading and drawing advanced schematic diagrams												
EL-09	Laying out, wiring and testing an alternating current (AC) circuit												
EL-10	Selecting wire size and making connections												
EL-11	Making main panel connections												

TASK LISTING BY DOT CODE

APPLIANCE REPAIR

POSSIBLE EXIT POINTS

	DOT DESCRIPTION	Electrical-Appliance Preparer	Household-Appliance Installer	Electrical-Appliance Servicer	Gas-Appliance Servicer Helper	Gas-Appliance Servicer	A/C Inst.-Servicer Helper, Window Unit	A/C Installer-Servicer, Window Unit	Gas Leak Tester	Refrigeration Mechanic Helper	Refrigerator Tester	Refrigeration Unit Repairer	
	DOT NO.	827.584-010	827.661-010	827.261-010	637.684-010	637.261-018	637.687-010	637.261-010	827.584-014	637.687-014	827.384-010	637.381-014	
TASK NO.	TASK NAME												
	DUTY B: Electric Motors												
EL-12	Installing and testing shaded pole motors												
EL-13	Installing and testing split phase motors												
EL-14	Checking capacitors for serviceability												
EL-15	Installing and testing permanent split capacitor (PSC) motors												
EL-16	Installing and testing capacitor start (CS) motors												
EL-17	Installing and testing capacitor start/run (CSR) motors												

TASK LISTING BY DOT CODE

APPLIANCE REPAIR

POSSIBLE EXIT POINTS

	DOT DESCRIPTION	Electrical-Appliance Preparer	Household-Appliance Installer	Electrical-Appliance Servicer	Gas-Appliance Servicer Helper	Gas-Appliance Servicer	A/C Inst.-Servicer Helper, Window Unit	A/C Installer-Servicer, Window Unit	Gas Leak Tester	Refrigeration Mechanic Helper	Refrigerator Tester	Refrigeration Unit Repairer	
	DOT NO.	827.584-010	827.661-010	827.261-010	637.684-010	637.261-018	637.687-010	637.261-010	827.584-014	637.687-014	827.384-010	637.381-014	
TASK NO.	TASK NAME												
EL-18	Troubleshooting electric motors												
EL-19	Servicing electric motors												
	DUTY C: Appliance Residential Wiring												
EL-20	Installing 115 volt AC appliance circuits												
EL-21	Installing split switched receptacles												
EL-22	Installing 230 volt AC appliance circuits												

TASK LISTING BY DOT CODE

APPLIANCE REPAIR

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	Electrical-Appliance Preparer	Household-Appliance Installer	Electrical-Appliance Servicer	Gas-Appliance Servicer Helper	Gas-Appliance Servicer	A/C Inst.-Servicer Helper, Window Unit	A/C Installer-Servicer, Window Unit	Gas Leak Tester	Refrigeration Mechanic Helper	Refrigerator Tester	Refrigeration Unit Repairer	
	DOT NO.	827.584-010	827.661-010	827.261-010	637.684-010	637.261-018	637.687-010	637.261-010	827.584-014	637.687-014	827.384-010	637.381-014	
	DUTY D: Blueprint Reading												
EL-23	Using standard measurements												
EL-24	Identifying and drawing electrical symbols												

TASK LISTING BY DOT CODE

APPLIANCE REPAIR

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	DOT NO.: 827.584-010 DOT DESCRIPTION: Electrical-Appliance Preparer	827.661-010 Household-Appliance Installer	827.261-010 Electrical-Appliance Servicer	637.684-010 Gas-Appliance Servicer Helper	637.261-018 Gas-Appliance Servicer	637.687-010 A/C Inst.-Servicer Helper, Window Unit	637.261-010 A/C Installer-Servicer, Window Unit	827.584-014 Gas Leak Tester	637.687-014 Refrigeration Mechanic Helper	827.384-010 Refrigerator Tester	637.381-014 Refrigeration Unit Repairer	
APPLIANCE INSTALLATION AND REPAIR													
	DUTY A: Install Electric Appliances												
AR-01	Installing and wiring an electric range												
AR-02	Installing and wiring a cook top												
AR-03	Installing and wiring an electric oven												
AR-04	Installing and wiring an electric clothes dryer												
AR-05	Installing and wiring an electric water heater												
AR-06	Installing and wiring a microwave oven												

TASK LISTING BY DOT CODE

APPLIANCE REPAIR

POSSIBLE EXIT POINTS

	DOT DESCRIPTION	Electrical-Appliance Preparer	Household-Appliance Installer	Electrical-Appliance Servicer	Gas-Appliance Servicer Helper	Gas-Appliance Servicer	A/C Inst.-Servicer Helper, Window Unit	A/C Installer-Servicer, Window Unit	Gas Leak Tester	Refrigeration Mechanic Helper	Refrigerator Tester	Refrigeration Unit Repairer	
	DOT NO.	827.584-010	827.661-010	827.261-010	637.684-010	637.261-018	637.687-010	637.261-010	827.584-014	637.687-014	827.384-010	637.381-014	
TASK NO.	TASK NAME												
AR-07	Installing and wiring a refrigerator or freezer												
AR-08	Installing an icemaker												
AR-09	Installing and wiring a trashcompactor												
AR-10	Installing and wiring a dishwasher												
AR-11	Installing, plumbing and wiring a clothes washer												
	DUTY B: Install Gas Appliances												
AR-12	Installing and plumbing a gas range												

TASK LISTING BY DOT CODE

APPLIANCE REPAIR

POSSIBLE EXIT POINTS

	DOT DESCRIPTION	Electrical-Appliance Preparer	Household-Appliance Installer	Electrical-Appliance Servicer	Gas-Appliance Servicer Helper	Gas-Appliance Servicer	A/C Inst.-Servicer Helper, Window Unit	A/C Installer-Servicer, Window Unit	Gas Leak Tester	Refrigeration Mechanic Helper	Refrigerator Tester	Refrigeration Unit Repairer	
	DOT NO.	827.584-010	827.661-010	827.261-010	637.684-010	637.261-018	637.687-010	637.261-010	827.584-014	637.687-014	827.384-010	637.381-014	
TASK NO.	TASK NAME												
AR-13	Installing and plumbing a gas oven												
AR-14	Installing and plumbing a gas clothes dryer												
AR-15	Installing and plumbing a gas water heater												
AR-16	Installing and plumbing a gas space heater												
AR-17	Installing an outdoor gas grill												
AR-18	Installing a gas appliance vent												
	DUTY C: Repair Electric Appliances												
AR-19	Testing electronic circuitry												

TASK LISTING BY DOT CODE

APPLIANCE REPAIR

POSSIBLE EXIT POINTS

	DOT DESCRIPTION	Electrical-Appliance Preparer	Household-Appliance Installer	Electrical-Appliance Servicer	Gas-Appliance Servicer Helper	Gas-Appliance Servicer	A/C Inst.-Servicer Helper, Window Unit	A/C Installer-Servicer, Window Unit	Gas Leak Tester	Refrigeration Mechanic Helper	Refrigerator Tester	Refrigeration Unit Repairer	
	DOT NO.	827.584-010	827.661-010	827.261-010	637.684-010	637.261-018	637.687-010	637.261-010	827.584-014	637.687-014	827.384-010	637.381-014	
TASK NO.	TASK NAME												
AR-20	Testing and replacing surface units and oven heating elements												
AR-21	Testing and replacing surface units and oven temperature control switches and thermostats												
AR-22	Testing and replacing the oven timer												
AR-23	Testing and replacing ceramic cook tops												
AR-24	Troubleshooting microwave ovens												
AR-25	Servicing electric dryer mechanical systems												
AR-26	Servicing electric dryer electrical systems												
AR-27	Testing and replacing electric water heater elements												

TASK LISTING BY DOT CODE

APPLIANCE REPAIR

POSSIBLE EXIT POINTS

	DOT DESCRIPTION	Electrical-Appliance Preparer	Household-Appliance Installer	Electrical-Appliance Servicer	Gas-Appliance Servicer Helper	Gas-Appliance Servicer	A/C Inst.-Servicer Helper, Window Unit	A/C Installer-Servicer, Window Unit	Gas Leak Tester	Refrigeration Mechanic Helper	Refrigerator Tester	Refrigeration Unit Repairer	
	DOT NO.	827.584-010	827.661-010	827.261-010	637.684-010	637.261-018	637.687-010	637.261-010	827.584-014	637.687-014	827.384-010	637.381-014	
TASK NO.	TASK NAME												
AR-28	Testing and replacing electric water heater thermostats												
AR-29	Testing and replacing dishwasher timer and solenoids												
AR-30	Testing and replacing dishwasher level control and door switches												
AR-31	Testing and replacing the dishwasher heating element and thermostat												
AR-32	Testing and replacing the dishwasher automatic dispenser												

TASK LISTING BY DOT CODE

APPLIANCE REPAIR

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	Electrical-Appliance Preparer	Household-Appliance Installer	Electrical-Appliance Servicer	Gas-Appliance Servicer Helper	Gas-Appliance Servicer	A/C Inst.-Servicer Helper, Window Unit	A/C Installer-Servicer, Window Unit	Gas Leak Tester	Refrigeration Mechanic Helper	Refrigerator Tester	Refrigeration Unit Repairer	
	DOT NO.	827.584-010	827.661-010	827.261-010	637.684-010	637.261-018	637.687-010	637.261-010	827.584-014	637.687-014	827.384-010	637.381-014	
AR-33	Testing and replacing the dishwasher drain pump												
AR-34	Testing and replacing the dishwasher motor and relay												
AR-35	Testing and replacing the clothes washer timer and solenoids												
AR-36	Testing and replacing the clothes washer water level control and door switches												
AR-37	Checking and replacing the clothes washer agitator												

TASK LISTING BY DOT CODE

APPLIANCE REPAIR

POSSIBLE EXIT POINTS

	DOT DESCRIPTION	Electrical-Appliance Preparer	Household-Appliance Installer	Electrical-Appliance Servicer	Gas-Appliance Servicer Helper	Gas-Appliance Servicer	A/C Inst.-Servicer Helper, Window Unit	A/C Installer-Servicer, Window Unit	Gas Leak Tester	Refrigeration Mechanic Helper	Refrigerator Tester	Refrigeration Unit Repairer	
	DOT NO.	827.584-010	827.661-010	827.261-010	637.684-010	637.261-018	637.687-010	637.261-010	827.584-014	637.687-014	827.384-010	637.381-014	
TASK NO.	TASK NAME												
AR-38	Testing and repairing the clothes washer drain pump												
AR-39	Testing and replacing the clothes washer clutch and transmission												
AR-40	Servicing and replacing the clothes washer motor and relay												
	DUTY D: Repair Gas Appliances												
AR-41	Heating and cooking with petroleum gases												
AR-42	Inspecting heat exchangers												

TASK LISTING BY DOT CODE

APPLIANCE REPAIR

POSSIBLE EXIT POINTS

	DOT DESCRIPTION	Electrical-Appliance Preparer	Household-Appliance Installer	Electrical-Appliance Servicer	Gas-Appliance Servicer Helper	Gas-Appliance Servicer	A/C Inst.-Servicer Helper, Window Unit	A/C Installer-Servicer, Window Unit	Gas Leak Tester	Refrigeration Mechanic Helper	Refrigerator Tester	Refrigeration Unit Repairer	
	DOT NO.	827.584-010	827.661-010	827.261-010	637.684-010	637.261-018	637.687-010	637.261-010	827.584-014	637.687-014	827.384-010	637.381-014	
TASK NO.	TASK NAME												
AR-43	Replacing gas orifices												
AR-44	Adjusting pilot lights												
AR-45	Replacing and adjusting main gas burners												
AR-46	Replacing and adjusting gas regulators												
AR-47	Testing, replacing and adjusting combination diaphragm valves												
AR-48	Testing and replacing electromagnetic safety devices												
AR-49	Testing, replacing and adjusting gas oven controls												

TASK LISTING BY DOT CODE

APPLIANCE REPAIR

		POSSIBLE EXIT POINTS											
	DOT DESCRIPTION	Electrical-Appliance Preparer	Household-Appliance Installer	Electrical-Appliance Servicer	Gas-Appliance Servicer Helper	Gas-Appliance Servicer	A/C Inst.-Servicer Helper, Window Unit	A/C Installer-Servicer, Window Unit	Gas Leak Tester	Refrigeration Mechanic Helper	Refrigerator Tester	Refrigeration Unit Repairer	
	DOT NO.	827.584-010	827.661-010	827.261-010	637.684-010	637.261-018	637.687-010	637.261-010	827.584-014	637.687-014	827.384-010	637.381-014	
TASK NO.	TASK NAME												
AR-50	Testing, replacing and adjusting gas range controls												
AR-51	Testing, replacing and adjusting gas/electric controls												
AR-52	Testing and replacing gas water heater relief valves												
AR-53	Testing and replacing gas water heater thermostats												
AR-54	Testing, replacing and adjusting water heater gas controls												

TASK LISTING BY DOT CODE

APPLIANCE REPAIR

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	DOT NO. 827.584-010 DOT DESCRIPTION Electrical-Appliance Preparer	827.661-010 Household-Appliance Installer	827.261-010 Electrical-Appliance Servicer	637.684-010 Gas-Appliance Servicer Helper	637.261-018 Gas-Appliance Servicer	637.687-010 A/C Inst.-Servicer Helper, Window Unit	637.261-010 A/C Installer-Servicer, Window Unit	827.584-014 Gas Leak Tester	637.687-014 Refrigeration Mechanic Helper	827.384-010 Refrigerator Tester	637.381-014 Refrigeration Unit Repairer	
AR-55	Servicing gas clothes dryer mechanical/electrical systems												
AR-56	Testing, replacing and adjusting dryer gas controls												
AR-57	Testing, replacing and adjusting gas space heater thermostats												
AR-58	Testing, replacing and adjusting space heater fan and controls												
AR-59	Testing, replacing and adjusting space heater gas controls												

TASK LISTING BY DOT CODE

APPLIANCE REPAIR

POSSIBLE EXIT POINTS

	DOT DESCRIPTION	Electrical-Appliance Preparer	Household-Appliance Installer	Electrical-Appliance Servicer	Gas-Appliance Servicer Helper	Gas-Appliance Servicer	A/C Inst.-Servicer Helper, Window Unit	A/C Installer-Servicer, Window Unit	Gas Leak Tester	Refrigeration Mechanic Helper	Refrigerator Tester	Refrigeration Unit Repairer	
	DOT NO.	827.584-010	827.661-010	827.261-010	637.684-010	637.261-018	637.687-010	637.261-010	827.584-014	637.687-014	827.384-010	637.381-014	
TASK NO.	TASK NAME												
AR-60	Testing, replacing and adjusting outdoor grill gas controls												

SECTION III

UNIT GUIDES

SECTION III

Section III Content List

Unit Guide Description
Suggested Sequence of Unit Guides

In Section II, the relationship between the occupational area and program tasks was introduced. Section III continues this development by presenting, for each task, a unit guide for instructional planning and execution.

The instruction of specific tasks is central to vocational education. However, the value of a single task/competency to the student as a prospective member of the workforce is dependent upon the way in which that task/competency is related to other tasks and to the entire occupational area. Therefore, the Appliance Repair Program Task Listing provides a sample organizational model for sequencing the instruction of program tasks.

UNIT GUIDES DESCRIPTION

In this section the tasks to be taught in each course are presented in sequential order. Each task is listed on a separate page so that it may be taken out of the guide for daily lesson planning or regrouped with order tasks to fit the individual teacher's preference for teaching order. The task pages may be used for planning and executing group instruction or for individualized instruction. Each page in the UNIT GUIDES section contains the following information:

TASK: This is a short and concise statement of the task to be taught.

PERFORMANCE OBJECTIVE: The performance expected of the student after completing the unit is stated in stem form, without a specific statement of all conditions, equipment and performance standard (these are listed in a criterion referenced measure in the Evaluation section of the task page).

INSTRUCTIONAL ACTIVITIES: Suggested learning activities are presented. These activities include providing information, demonstration, practical applications and projects.

INSTRUCTIONAL MATERIALS: Suggested materials for carrying out the instructional activities are listed. these include textbooks, audiovisuals and equipment. Textbooks are referenced by author and title with the complete reference contained in the textbook list in the Instructional Resources section.

EVALUATION: This section contains a criterion referenced measure and reference to any test items or other evaluation measures that are available to teacher.

CLASS/LAB HOURS: The estimated time for completion of the instructional activities and the evaluation are indicated in both classroom and lab hours. Total instructional time would be the sum of these.

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TASK

EL-01 Identifying safe working conditions

PERFORMANCE OBJECTIVE

Identify and practice safe working habits in the laboratory and in the work place.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Shop safety rules
b. Protective clothing
c. Fire hazards
d. Electrical hazards
e. Freon hazards
f. Types of safety equipment
    1. Fire extinguishers
    2. Clothing
    3. First aid supplies
g. First aid

Provide Demonstration On:

a. Use of safety equipment
b. Proper handling of equipment
c. First aid

Provide Practical Application On:

a. Handling fire extinguishers
b. Using first aid practices

INSTRUCTIONAL MATERIALS

Textbooks:

a. Althouse, *Modern Refrigeration and Air Conditioning*
b. Carrier Corp., *A Safety Guide for Refrigeration and Air Conditioning*
c. Prentice-Hall, *Refrigeration and Air Conditioning*

A/Vs:

Georgia, "Identifying Safe Working Conditions," slide/tape REF-02

Student Manuals:

Georgia, *Refrigeration*, Unit REF-02

Tools and Equipment:

a. Fire extinguishers
b. First aid supplies

LAB HOURS 1

CLASS HOURS 3

EVALUATION (EL-01)

Given a list of standard shop materials, equipment and practices, the student will identify safe and unsafe practices and precautionary measures to be taken to prevent hazardous situations. Ninety percent (90%) accuracy is required.

TASK

EL-02 Using basic electrical theory

PERFORMANCE OBJECTIVE

Demonstrate an understanding of basic electrical theory.

INSTRUCTIONAL ACTIVITIES

Provide information On:

a. Atoms
    1. Nucleus
    2. Protons
    3. Neutrons
    4. Electrons
    5. Orbits
    6. Free electrons
    7. Flow of electrons
b. Law of electrical charges
c. Production of electricity
    1. Static
    2. Chemical
    3. Generator
d. Conductors
e. Insulators
f. Electromotive force
g. Current

Provide Demonstration On:

a. Composition of an atom
b. Safety and first aid procedures

(Continued on back)

INSTRUCTIONAL MATERIALS

Textbooks:

a. Smith, Electricity for Refrigeration, Heating and Air Conditioning
b. Whirlpool, Basic Electricity for Appliances

A/Vs:

a. Georgia, "Understanding Basic Electrical Theory," slide/tape EL-01
b. Whirlpool, "Basic Electricity for Appliances," transparencies

Student Manuals:

a. Georgia, Electricity, Unit EL-01
b. Whirlpool, Basic Electricity for Appliances

LAB HOURS 8

CLASS HOURS 2

EVALUATION (EL-02)

a. Given a drawing of an atom, the student will correctly identify the parts of the atom and will match electrical terms with their proper definitions. All labeling and matching must be correct.

b. Georgia, Heating and Air Conditioning, Instructor Guide, Vol. IV, 1980.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

h. Resistance
i. Electric circuit
j. Volts
k. Amperage
l. Ohms
m. Watts
n. Electrical safety

TASK

EL-03 Computing Ohm's law and power formulas

PERFORMANCE OBJECTIVE

Make calculations using Ohm's law and power formulas

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Ohm's law
b. Function and use of Ohm's law
c. Power formulas
d. Function and use of power formulas
e. Relationship of Ohm's law and power formulas

Provide Demonstration On:

Problems using Ohm's law and power formulas

Provide Practical Application On:

Calculating additional information on electrical equipment using Ohm's law and power formulas from information on the data plate of the equipment

INSTRUCTIONAL MATERIALS

Textbooks:

Smith, Electricity for Refrigeration, Heating and Air Conditioning

Student Manuals:

Georgia, Electricity, Unit EL-02

Tools and Equipment:

a. Electrical tools and equipment with a data plate
b. National Electric Code (NEC)

LAB HOURS	8
CLASS HOURS	2

EVALUATION (EL-03)

a. Given appliance electrical requirements, the student will solve for unknown values using Ohm's law and power formulas. All results must be within 5% of known values.

b. Georgia, Heating and Air Conditioning, Instructor Guide, Vol. IV, 1980.

TASK

EL-04 Using electric meters

PERFORMANCE OBJECTIVE

Read voltage, amperage and Ohm's using various electric test meters.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of ammeters
b. Function of electric meters
c. Reading meters
d. Using data plate to set meters
e. Volt-ohm-millimeter (VOM)
f. Components of a VOM
g. Ohms scale
h. Reading a VOM
i. Measuring voltage with a VOM
j. Non-linear

Provide Demonstration On:

Reading test meters

Provide Practical Application On:

a. Reading various types of test meters
b. Calibrating meters using given data

INSTRUCTIONAL MATERIALS

Textbooks:

Smith, Electricity for Refrigeration, Heating and Air Conditioning

A/Vs:

Georgia, "Using Electric Meters," slide/tape EL-03a, EL-03b, EL-03c

Student Manuals:

Georgia, Electricity, Unit EL-03

Tools and Equipment:

Various electric meters

LAB HOURS	6
CLASS HOURS	2

EVALUATION (EL-04)

a. Given an electric meter and voltage, amperage and resistance supply, the student will calibrate the meter and read all electrical quantities to within 5% of known data.

b. Georgia, Heating and Air Conditioning, Instructor Guide, Vol. IV, 1980.

TASK

EL-05 Identifying electrical symbols

PERFORMANCE OBJECTIVE

Identify electrical symbols and describe their meanings.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. The function of symbols in wiring diagrams
b. Symbols for
    1. Loads
        -Motors
        -Solenoids
        -Heaters
        -Signal lights
    2. Contactors and relays
    3. Magnetic starter
    4. Switches
        -Throw
        -Thermostats
        -Pressure switches
        -Pushbutton switches
        -Connect switches

(Continued on back)

Provide Demonstration On:

a. Using symbols in combination
b. Reading various kinds of wiring diagrams

Provide Practical Application On:

Identifying symbols and interpreting their meaning in wiring diagrams

INSTRUCTIONAL MATERIALS

Textbooks:

Smith, Electricity for Refrigeration, Heating and Air Conditioning

A/Vs:

Georgia, "Identifying Symbols," slide/tape EL-05a, EL-05b, EL-05c, EL-05d

Student Manuals:

Georgia, Electricity, Unit EL-05

Tools and Equipment:

a. Electrical symbol chart
b. Assorted electrical components
c. Wiring diagrams

LAB HOURS 4
CLASS HOURS 4

EVALUATION (EL-05)

a. The student will match electrical symbols with their corresponding electrical components with 100% accuracy.

b. Georgia, Heating and Air Conditioning, Post-Secondary, 1980.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

5. Safety devices
   -Overloads
6. Transformers

TASK

EL-06 Drawing basic schematic diagrams

PERFORMANCE OBJECTIVE

Draw and interpret schematic diagrams.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Definition of a schematic diagram
b. Elements in a schematic diagram
    1. Power source
    2. Current paths
    3. Load
c. Reading simple schematic diagrams
d. Applying symbols

Provide Demonstration On:

Reading a schematic diagram

Provide Practical Application On:

Drawing a schematic diagram to given specifications

INSTRUCTIONAL MATERIALS

Textbooks:

Smith, *Electricity for Refrigeration, Heating and Air Conditioning*

A/Vs:

Georgia, "Reading a Basic Schematic Diagram," slide/tape EL-06

Student Manuals:

Georgia, *Electricity*, Unit EL-06

Tools and Equipment:

a. Schematics
b. *NEC*

LAB HOURS	6
CLASS HOURS	4

EVALUATION (EL-06)

a. Given a list of basic specifications and necessary tools and equipment, the student will draw a schematic diagram to represent the specifications. All drawings must be straight, clean, readable and in accordance with NEC.

b. Georgia, Heating and Air Conditioning, Instructor Guide, Vol. IV, 1980.

TASK

EL-07 Laying out and wiring series and parallel circuits

PERFORMANCE OBJECTIVE

Lay out and wire series, parallel and series/parallel circuits.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Requirements for an electric current
b. Electrical load
c. Method of controlling the load
d. Characteristics of a series circuit
e. Uses of a series circuit
f. Measurement of electrical characteristics in series circuits
g. Parallel circuits
h. Uses of a parallel circuit
i. Measurement of electrical characteristics in a parallel circuit

(Continued on back)

Provide Demonstration On:

Calculations for the electrical quantities in series, parallel and combination circuits

Provide Practical Application On:

Laying out and wiring a series and parallel circuit using a wiring board and taking readings on the different components

INSTRUCTIONAL MATERIALS

Textbooks:

Smith, Electricity for Refrigeration, Heating and Air Conditioning

A/Vs:

Georgia, "Demonstrate a Knowledge of Series and Parallel Circuits," slide/tape EL-04a, EL-04b

Student Manuals:

Georgia, Electricity, Unit EL-04

Tools and Equipment:

a. Wiring board
b. Electrical wire
c. Test meters
d. Light sockets and lights
e. Power source
f. NEC

LAB HOURS	6
CLASS HOURS	2

EVALUATION (EL-07)

a. Given a wiring board and necessary tools and equipment, the student will draw a series/parallel circuit from given specifications and wire and test the circuit. All work must meet NEC. All readings must be within 5% of known readings.

b. Georgia, Heating and Air Conditioning, Instructor Guide, Vol. IV, 1980.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

j. Series/parallel circuit
k. Uses of the S/P circuit
l. Measurement of electrical characteristics in the S/P circuit
m. Drawing the circuit

TASK

EL-08 Reading and drawing advanced schematic diagrams

PERFORMANCE OBJECTIVE

Draw and interpret advanced schematic diagrams.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. A review of symbols and reading basic schematic diagrams
b. The relationship of a schematic diagram with the actual electrical unit
c. Pictorial diagrams
d. Factual diagrams
e. Installation diagrams

Provide Demonstration On:

a. Reading an advanced schematic diagram
b. Reading other types of wiring diagrams

Provide Practical Application On:

Drawing an advanced schematic diagram to given specifications

INSTRUCTIONAL MATERIALS

Textbooks:

Smith, Electricity for Refrigeration, Heating and Air Conditioning

Student Manuals:

Georgia, Electricity, Unit EL-07

Tools and Equipment:

a. Advanced schematic diagram
b. NEC

LAB HOURS 6
CLASS HOURS 4

EVALUATION (EL-08)

a. Given a list of specifications and necessary tools and equipment, the student will draw a schematic diagram to represent specifications. All drawings must be straight, clean, readable and in accordance with NEC.

b. Georgia, Heating and Air Conditioning, Instructor Guide, Vol. IV, 1980.

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TASK

EL-09 Laying out, wiring and testing an alternating current (AC) circuit

PERFORMANCE OBJECTIVE

Layout, wire and test an AC circuit.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Definition of alternating current
b. Basic concepts of alternating current
    1. Sine wave
    2. Cycles and frequency
    3. Effective voltage
    4. Voltage - current systems
    5. Phase
    6. Inductance and reactance
        -Inductive reactance
        -Capacitive reactance
        -Impedance
    7. Power
        -True power
        -Apparent power
        -Power factor
        -Power distribution
c. Single phase alternating current systems
d. Three-phase voltage systems
e. Higher-voltage systems
f. Advantages and disadvantages of different systems
g. Measurement of current, voltage and amperage
h. Transformer hookups
    1. Delta
    2. Wye

INSTRUCTIONAL MATERIALS

Textbooks:

Smith, Electricity for Refrigeration, Heating and Air Conditioning

Student Manuals:

Georgia, Electricity, Unit EL-08

Tools and Equipment:

a. Volt meter
b. Wiring panels
c. Delta and Wye voltage systems
d. NEC

LAB HOURS	6
CLASS HOURS	2

EVALUATION (EL-09)

a. Given necessary tools and equipment, the student will draw a power distribution system to given specifications, wire up the system in accordance with NEC and measure voltage and amperage. All readings must be within 5% of actual value.

b. Georgia, Heating and Air Conditioning, Instructor Guide, Vol. IV, 1980.

INSTRUCTIONAL ACTIVITIES

Provide Practical Application On:

a. Measuring the voltage of a:
   1. 230v1Ø-60hz voltage system
   2. Delta (230v-3Øhz)
   3. Wye (208-3-60) voltage system
   4. 460v-3Ø-60hz voltage system

b. Making connections in the panel to obtain:
   1. 230v-1-60 cycles
   2. 115-1-60 cycles
   3. 280-3-60 cycles
   4. 230-3-60 cycles
   5. 460v-3Ø-60hz cycles

c. Identifying the ground, hot legs and high legs
   1. 230v-1Ø-60hz voltage system
   2. 230v-3Ø-60hz voltage system
   3. 460v-3Ø-60hz voltage system

d. Drawing a power distribution system, given various specifications, from an electrical source, to a substation, to a transformer, to a structure

TASK

EL-10 Selecting wire size and making connections

PERFORMANCE OBJECTIVE

Determine wire size and type per ampacity.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Regulations of the National Electrical Code
b. Wiring characteristics
  1. Type of metal
  2. Insulation
  3. Size
c. Wire-sizing charts
d. Ampacity
e. Voltage drop
f. Disconnect switches
  1. Enclosures
  2. Fusible and non-fusible switches
g. Fusible load centers
h. Breaker panels
i. Distribution centers
j. Making connections

Provide Demonstration On:

Various wire sizes and types for different electrical units

Provide Practical Application On:

Sizing wire for a range, cook top and electric water heater

INSTRUCTIONAL MATERIALS

Textbooks:

Smith, Electricity for Refrigeration, Heating and Air Conditioning

A/Vs:

Georgia, "Determining, Selecting Wire Size and Making Connections," slide/tape, EL-09a, EL-09b

Student Manuals:

Georgia, Electricity, Post Secondary

Tools and Equipment:

a. Various types and sizes of wire
b. Wire-sizing charts
c. NEC

LAB HOURS	6
CLASS HOURS	6

EVALUATION (EL-10)

a. Given two major appliances (110v and 220v) with specifications and equipment, the student will determine and select the wire size for connecting the unit. Selection must meet NEC specifications.

b. Georgia, Heating and Air Conditioning, Instructor Guide, Vol. IV, 1980.

TASK

EL-11 Making main panel connections

PERFORMANCE OBJECTIVE

Make a main panel connection for a major appliance.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Disconnect switch
b. Load side of the disconnect
c. Connection of power wires
d. Connection of ground wires
e. Single phase disconnect
f. Three phase disconnect
g. Fusible load center
h. Distribution center
i. Breaker panels
    1. Main breakers
    2. Installation
        -Type and size of wiring
    3. Pole breakers

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Provide Demonstration On:

Panel connections for an air conditioner

Provide Practical Application On:

a. Making a main panel connection for an appliance
b. Making connections in a fusible load center
c. Installing various types of circuit breakers in a breaker panel

INSTRUCTIONAL MATERIALS

Textbooks:

Smith, *Electricity for Refrigeration, Heating and Air Conditioning*

A/Vs:

Georgia, "Making Main Panel Connections," slide/tape EL-10a, EL-10b

Student Manuals:

Georgia, *Electricity*, Unit EL-10

Tools and Equipment:

a. Air conditioning unit
b. Breaker panel
c. Wiring
d. Small hand tools
e. *NEC*

LAB HOURS	6
CLASS HOURS	2

EVALUATION (EL-11)

a. Given proper equipment and materials, the student should make the proper main panel connections for an electric appliance. All work must conform to NEC.

b. Georgia, Heating and Air Conditioning, Instructor Guide, Vol. IV, 1980.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

j. Correcting faulty connections
k. Connections for air conditioners
l. Fuses

TASK

EL-12 Installing and testing shaded pole motors

PERFORMANCE OBJECTIVE

Install, wire and test a shaded pole motor.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Electric motors
    1. Torque
    2. Magnetism
        -Magnetic field
        -Induced magnetism
        -Permanent magnet
        -Electromagnet
    3. Rotor
    4. Stator
    5. Motor strength
    6. Open and enclosed motors
b. Types of motors
    1. Shaded pole
    2. Split phase

(Continued on back)

Provide Demonstration On:

a. The various types of motors
b. A shaded pole motor

Provide Practical Application On:

a. Diagnosing malfunctions in a shaded pole motor
b. Installing and testing the motor

INSTRUCTIONAL MATERIALS

Textbooks:

Smith, *Electricity for Refrigeration, Heating and Air Conditioning*

A/Vs:

Georgia, "Servicing Shaded Pole Motors," slide/tape EL-11a, EL-11b

Student Manuals:

Georgia, *Electricity*, Unit EL-11

Tools and Equipment:

a. Shaded pole motor
b. Hand tools
c. *NEC*

LAB HOURS	5
CLASS HOURS	1

EVALUATION (EL-12)

a. Given a shaded pole motor and equipment, the student will wire the motor and test for condition. Wiring must conform to NEC. Test results must equal known values.

b. Georgia, Heating and Air Conditioning, Instructor Guide, Vol. IV, 1980.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

3. Permanent split capacitor
4. Capacitor-start-capacitor run
5. Three-phase

c. Shaded-pole motor
1. Operation
2. Reversing
3. Troubleshooting
   -Winding
   -Bearings

TASK

EL-13 Installing and testing split phase motors

PERFORMANCE OBJECTIVE

Install, wire and test a 230 volt split phase motor.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Electric motors
b. Components of a motor
c. Split phase motors
    1. Winding layout
    2. Voltage
    3. Centrifugal switch
    4. Dual voltage split phase motor
d. Wiring a split phase motor
e. Operation of a split phase motor
f. Diagnosing malfunctions
g. Hermetic

Provide Demonstration On:

A split phase motor in operation

Provide Practical Application On:

a. Installing and testing a split phase motor
b. Diagnosing malfunctions in split phase motors

INSTRUCTIONAL MATERIALS

Textbooks:

Smith, Electricity for Refrigeration, Heating and Air Conditioning

A/Vs:

Georgia, "Servicing Shaded-Pole Motors," slide/tape EL-11b

Student Manuals:

Georgia, Electricity, Unit EL-12

Tools and Equipment:

a. Split phase motor
b. Hand tools
c. NEC

LAB HOURS 5

CLASS HOURS 1

EVALUATION (EL-13)

a. Given a split phase motor and necessary tools and equipment, the student will wire the motor and test for condition. Wiring must conform to NEC. Test results must equal known values.

b. Georgia, Heating and Air Conditioning, Instructor Guide, Vol. IV, 1980.

TASK

EL-14 Checking capacitors for serviceability

PERFORMANCE OBJECTIVE

Diagnose the condition and identify replacement capacitors on electric motors.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Function of a capacitor
b. Starting capacitor
c. Running capacitor
d. Microfarad
e. Checking a capacitor with an ohmmeter
f. Other capacitor testers
g. Capacitor rules
h. Total capacitance of a capacitor
i. Diagnosing manfunctions

Provide Demonstration On:

a. A capacitor and its component parts
b. Calculating the capacitance of a capacitor

Provide Practical Application On:

a. Diagnosing malfunctions in different types of capacitors
b. Identifying replacement capacitors

INSTRUCTIONAL MATERIALS

Textbooks:

Smith, Electricity for Refrigeration, Heating and Air Conditioning

A/Vs:

Georgia, "Checking Capacitors," slide/tape EL-13

Student Manuals:

Georgia, Electricity, Unit EL-13

Tools and Equipment:

a. Capacitor
b. Ohmmeter
c. Volt meter
d. Hand tools

LAB HOURS	3
CLASS HOURS	1

EVALUATION (EL-14)

a. Given an electric motor utilizing a capacitor with a faulty capacitor, the student will locate the problem and replace the capacitor. Replacement capacitor must be equal to the original.

b. Georgia, Heating and Air Conditioning, Instructor Guide, Vol. IV, 1980.

TASK

EL-15 Installing and testing permanent split capacitor (PSC) motors

PERFORMANCE OBJECTIVE

Wire, install and test a PSC motor.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Functioning of a permanent split capacitor motor
b. Component parts of a PSC motor
c. Diagnosing malfunctions in a PSC motor
   -Capacitor
   -Motor windings
   -Bearings
d. Multi-speed PSC motors

Provide Demonstration On:

A PSC motor in operation

Provide Practical Application On:

a. Diagnosing malfunctions in a multi-speed motor
b. Installing the PSC motor

INSTRUCTIONAL MATERIALS

Textbooks:

Smith, Electricity for Refrigeration, Heating and Air Conditioning

Student Manuals:

Georgia, Electricity, Unit EL-14

Tools and Equipment:

a. A PSC motor
b. Hand tools
c. NEC

LAB HOURS	5
CLASS HOURS	1

EVALUATION (EL-15)

a. Given a PSC motor and necessary tools and equipment, the student will wire the motor and test for condition. Wiring must conform to NEC. Test results must equal known values.

b. Georgia, Heating and Air Conditioning, Instructor Guide, Vol. IV, 1980.

TASK

EL-16 Installing and testing capacitor start (CS) motors

PERFORMANCE OBJECTIVE

Wire, troubleshoot and install an open type CS motor.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Function and characteristics of a CS motor
b. Open type CS motor
c. Enclosed type CS motor
d. Diagnosing malfunctions
e. Component parts of a CS motor
f. Relay type

Provide Demonstration On:

An operating CS motor

Provide Practical Application On:

a. Diagnosing malfunctions in a CS motor
b. Installing a CS motor

INSTRUCTIONAL MATERIALS

Textbooks:

Smith, Electricity for Refrigeration, Heating and Air Conditioning

A/Vs:

Georgia, "Hooking Up and Troubleshooting CS Motors," slide/tape EL-15

Student Manuals:

Georgia, Electricity, Unit EL-15

Tools and Equipment:

a. A CS motor
b. Hand tools
c. NEC

LAB HOURS 5

CLASS HOURS 1

EVALUATION (EL-16)

a. Given an open type CS motor and necessary tools and equipment, the student will wire the motor and test for conditions. Wiring must conform to NEC. Test results must equal known values.

b. Georgia, Heating and Air Conditioning, Instructor Guide, Vol. IV, 1980.

TASK

EL-17 Installing and testing capacitor start/run (CSR) motors

PERFORMANCE OBJECTIVE

Troubleshoot and connect a CSR motor and starting relay.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Function of a capacitor start capacitor run CSR motor
b. Component parts of a CSR motor
c. Operation of a CSR motor
d. Connecting a CSR motor
e. Diagnosing malfunctions
    1. Windings
    2. Bearings
    3. Potential relays
    4. Starting capacitor
    5. Running capacitor
    6. Relay
    7. Compressor

Provide Demonstration On:

A functioning CSR motor

Provide Practical Application On:

a. Diagnosing malfunctions in a CSR motor
b. Wiring and operating a CSR motor

INSTRUCTIONAL MATERIALS

Textbooks:

Smith, Electricity for Refrigeration, Heating and Air Conditioning

A/Vs:

Georgia,"Hooking Up and Troubleshooting a CSR Motor," slide/tape EL-16

Student Manuals:

Georgia, Electricity, Unit EL-16

Tools and Equipment:

a. CSR motor
b. Hand tools
c. NEC

LAB HOURS	4
CLASS HOURS	2

EVALUATION (EL-17)

a. Given a CSR motor and necessary tools and equipment, the student will wire the motor using a potential relay and test the motor for condition. Wiring must conform to NEC. Test results must equal known values.

b. Georgia, Heating and Air Conditioning, Instructor Guide, Vol. IV, 1980.

TASK

EL-18 Troubleshooting electric motors

PERFORMANCE OBJECTIVE

Determine failure causes of shaded pole, split phase, PSC, CS and CSR motors.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Parts nomenclature
b. Characteristics of each type motor
c. Use of each type of motor
d. Testing methods for each type of motor
e. Repairing each type of motor

Provide Demonstration On:

a. Each motor in operation
b. Testing each motor

Provide Practical Application On:

Testing and replacing brushes, capacitors, relays, field coils, armatures, bearings and end caps of electric motors used in the appliance industry

INSTRUCTIONAL MATERIALS

Textbooks:

Smith, Electricity for Refrigeration, Heating and Air Conditioning

Student Manuals:

Georgia, Electricity, Unit EL-18

Tools and Equipment:

a. Motors (shaded pole, split phase, PSC, CS, CSR)
b. Hand tools
c. Ohmmeter
d. Voltage meters

LAB HOURS 6
CLASS HOURS 2

EVALUATION (EL-18)

a. Given a selection of inoperable appliance motors and necessary tools and equipment, the student will select a specific motor, identify the type and determine the cause of failure. One hundred percent accuracy is required.

b. Georgia, Heating and Air Conditioning, Instructor Guide, Vol. IV, 1980.

TASK

EL-19 Servicing electric motors

PERFORMANCE OBJECTIVE

Perform maintenance on electric motors, including changing and lubricating bearings, aligning belts and installing drive couplings

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Motor types and three characteristics
b. Component parts of motors
    1. Relays
    2. Motor bearings
    3. Motor drives
        -Belts
        -Couplings
    4. Starters
    5. Switches
c. Maintenance activities
d. Testing motors

Provide Demonstration On:

Maintaining various parts of an electric motor

Provide Practical Application On:

a. Inspecting direct drive motors and listing coupling types
b. Adjust the V-belt on various motors
c. Changing and lubricating bearings

INSTRUCTIONAL MATERIALS

Textbooks:

Smith, Electricity for Refrigeration, Heating and Air Conditioning

Student Manuals:

Georgia, Electricity, Unit EL-19

Tools and Equipment:

a. Various motor types
b. V-belts
c. Bearings
d. Hand tools
e. Manufacturer's manual

LAB HOURS 6

CLASS HOURS 2

EVALUATION (EL-19)

a. Given a selection of appliance motors and necessary tools and equipment, the student will lubricate and/or replace bearings and bushings, inspect and adjust belts and install drive couplings. This must be done according to manufacturer's specifications.

b. Georgia, Heating and Air Conditioning, Instructor Guide, Vol. IV, 1980.

TASK

EL-20 Installing 115 volt AC appliance circuits

PERFORMANCE OBJECTIVE

Install a 115v appliance outlet including the necessary wiring for the distribution panel and outlet box.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Reading an appliance nameplate
    1. Type of appliance
    2. Full load amps
    3. Voltage required
    4. Breaker required
    5. Wire size required
b. Designing a 115v appliance outlet circuit
c. Pigtail grounding connections
d. Grounding receptacles
e. Ground Fault Interruptor (GFI)
f. Locating the outlet
g. Reason for a separate appliance circuit

(Continued on back)

Provide Demonstration On:

a. Selecting wire size, outlet and fuses or breakers
b. Mounting a breaker or fuse in a distribution panel
c. Running the wire and connector to outlet

Provide Practical Application On:

a. Mounting distribution panel and outlet box
b. Determining amperage rating of assigned appliance

(Continued on back)

INSTRUCTIONAL MATERIALS

Textbooks:

Alerich, Electrical Construction Wiring

A/Vs:

a. Georgia, "Installing 115v Appliance Outlets," slide/tape REW-01a
b. Bergwall, "Small Appliance Circuits," filmstrip

Student Manuals:

a. Georgia, Residential Electrical Wiring: Secondary, Unit REW-01
b. MAVCC, Residential Wiring

Tools and Equipment:

a. 115v grounded outlet
b. Outlet box
c. Breakers
d. Wire
e. Tool kit
f. NEC

LAB HOURS 8

CLASS HOURS 2

EVALUATION (EL-20)

a. Given necessary tools and equipment, the student will wire a 115v appliance outlet according to NEC standards.

b. MAVCC, Residential Wiring, Teacher Edition, 1978.

c. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

h. Wall boxes
    1. Metal
    2. Plastic
i. Wire types and sizes
j. Determining wire and breaker size

Provide Practical Application On:

c. Selecting appropriate size breaker and mount in panel
d. Selecting proper wire sizes
e. Wiring the distribution panel and outlet

TASK

EL-21 Installing split switched receptacles

PERFORMANCE OBJECTIVE

Design and install a circuit with a split switched receptacle.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Purpose of switched receptacles
b. Converting standard switches and receptacles into a split or combination type
c. Manufactured split switches and receptacles
d. Combination switch and receptacle
e. Duplex switches
f. Split-wired duplex receptacle switches
g. Key operated switches
h. AC quiet switches
i. Door switches
j. NEC standards

Provide Demonstration On:

Converting standard switches and receptacles into split or combination types

Provide Practical Application On:

a. Drawing a circuit with a duplex receptacle and a combination receptacle so the receptacle of the combination switch remains hot
b. Wireing a circuit for a disposal unit using a split switch receptacle

INSTRUCTIONAL MATERIALS

Textbooks:

Alerich, Electrical Construction Wiring

A/Vs:

Georgia, "Installing Split and Switched Receptacles," slide/tape REW-04a and REW-04b

Student Manuals:

a. Georgia, Residential Electrical Wiring: Secondary, Unit REW-04
b. MAVCC, Residential Wiring

Tools and Equipment:

a. Outlet boxes
b. Receptacles
c. Wires
d. Breakers
e. NEC

LAB HOURS	8
CLASS HOURS	2

EVALUATION (EL-21)

a. Given necessary tools and equipment, the student will design and wire a circuit with a switched combination receptacle with outlet remaining hot. The installation must meet NEC and local standards.

b. MAVCC, Residential Wiring, Teacher Edition, 1978.

c. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

EL-22 Installing 230 volt AC appliance circuits

PERFORMANCE OBJECTIVE

Install a 230 volt AC appliance outlet including the necessary wiring for the distribution panel and outlet box.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of 230v outlets
b. Junction boxes
c. 230v breakers
    1. Double pole
    2. Single pole
d. Ratings of 230v breakers
e. Wiring a 230v outlet
f. Connections at breaker boxes for 230v

Provide Demonstration On:

a. Selecting wire size, breakers and outlet
b. Installing 230v breakers

Provide Practical Application On:

a. Selecting the appropriate size breaker, wire and outlet (if any) for a given major appliance
b. Drawing a hot water heater heater circuit
c. Wiring a hot water heater
d. Drawing a circuit for a 230v receptacle and wire both a flush and a surface mount receptacle

INSTRUCTIONAL MATERIALS

Textbooks:

Alerich, Electrical Construction Wiring

A/Vs:

a. Georgia, "Installing 230v Circuits and Outlets," slide/tape REW-07a
b. Bergwall, "Special Purpose Outlets," filmstrip

Student Manuals:

a. Georgia, Residential Electrical Wiring: Secondary, Unit REW-07
b. MAVCC, Residential Wiring

Tools and Equipment:

a. Tool kit
b. Wire
c. 230v breakers
d. Surface mount receptacle
e. Flush mount receptacle

(Continued on back)

LAB HOURS	8
CLASS HOURS	2

EVALUATION (EL-22)

a. Given necessary tools and equipment, the student will install a 230v receptacle according to NEC standards.

b. MAVCC, Residential Wiring, Teacher Edition, 1978.

c. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

f. Hot water heater
g. Voltohmmeter
h. NEC

TASK

EL-23 Using standard measurements

PERFORMANCE OBJECTIVE

Read and use common layout and measuring devices.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Purpose of measuring devices
b. Graduations
    1. 1/8"
    2. 1/16"
c. Reducing a fractional measurement to its lowest terms (lowest common denominator)

Provide Demonstration On:

Reducing a fractional measurement to its lowest terms

Provide Practical Application On:

a. Identifying several given graduations on a chart of a ruler
b. Using a ruler or tape measure to measure several assigned items in the lab to within 1/16" accuracy

INSTRUCTIONAL MATERIALS

Student Manuals:

a. Georgia: Residential Electrical Wiring: Secondary, Unit REW-11
b. MAVCC, Residential Wiring
c. Georgia, Electro-Mechanics Mathematics, Chapter Nine

Tools and Equipment:

a. Ruler
b. Tape measure

LAB HOURS	8
CLASS HOURS	4

EVALUATION (EL-23)

Given a tape measure or ruler, the student will make several assigned linear measurements in the laboratory. The measurements must be within 1/16" accuracy. The student will express any fractional measurement to its lowest terms.

TASK

EL-24 Identifying and drawing electrical symbols

PERFORMANCE OBJECTIVE

Identify and draw electrical symbols for an assigned circuit.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Electrical symbols
b. Designing and drawing circuits
    1. Drawing symbols
    2. Drawing wiring
    3. NEC standards
c. Using the power formula to figure amperage

Provide Demonstration On:

Review working example power formula problems to determine ampacities

Provide Practical Application On:

a. Identifying electrical symbols on a chart
b. Drawing all appliance outlets on a floor plan according to NEC standards

INSTRUCTIONAL MATERIALS

Textbooks:

Smith, Electricity for Refrigeration, Heating and Air Conditioning

A/Vs:

Georgia, "Identifying Residential Wiring Symbols and Designing Circuits," slide/tape REW-12a

Student Manuals:

a. Georgia, Residential Electrical Wiring: Secondary, Unit REW-12
b. MAVCC, Residential Wiring

Tools and Equipment:

a. Blueprints
b. NEC

LAB HOURS	12
CLASS HOURS	4

EVALUATION (EL-24)

a. Given a floor plan, the student will draw all electrical symbols and wiring circuits according to NEC standards.

b. MAVCC, Residential Wiring, Teacher Edition, 1978.

c. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

AR-01 Installing and wiring an electric range

PERFORMANCE OBJECTIVE

Install and wire a free standing electric range.

INSTRUCTIONAL ACTIVITIES

Prerequisite Tasks:

EL-01 through EL-11, EL-22

Provide Information On:

a. Electrical safety
b. Uncrating and preparing the appliance
c. Determining electrical requirements
d. Using the power formula
e. The National Electric Code (NEC)
f. Installation procedures
g. Tools required
h. Operational checks

Provide Demonstration On:

a. Using NEC to determine requirements
b. Making wiring connections
c. Typical installations

Provide Practical Application On:

a. Determining size and type of wire, number of conductors and amperage rating of receptacle for a given stove
b. Installing a range pigtail
c. Making operational checks

INSTRUCTIONAL MATERIALS

Textbooks:

a. Ruel and Nolte, Servicing Electrical Appliances, Vol. 2
b. Alerich, Electrical Construction Wiring
c. Mullin, Electrical Wiring-Residential

A/Vs:

a. Georgia, "Installing Electric Range," slide/tape MA-01a, MA-01b; "Transporting Major Appliances," slide/tape MA-09a
b. AAVIM, "Electrical Wiring," slide/tape

Student Manuals:

a. Georgia, Major Appliances: Secondary, Units MA-01, MA-09
b. AAVIM, Electric Wiring, Unit 305SW

Tools and Equipment:

(Continued on back)

LAB HOURS	10
CLASS HOURS	6

EVALUATION (AR-01)

a. Given an electric range and necessary tools and equipment, the student will determine correct wire specifications and install and wire the range in accordance with the NEC and local codes.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

c. V'TECS, Appliance Repairer, Task No. 5.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

a. Shop tools
b. Various wire sizes and receptacles
c. Appliances
d. NEC manual
e. Local codes

TASK

AR-02 Installing and wiring a cook top

PERFORMANCE OBJECTIVE

Install and wire an electric cook top in a prepared counter surface and install the vent.

INSTRUCTIONAL ACTIVITIES

Prerequisite Tasks:

EL-01 through EL-11, EL-22

Provide Information On:

a. Types of cook tops (standard, ceramic)
b. Electrical safety
c. Uncrating and preparing the appliance
d. Determining electrical requirements
e. Using the power formula
f. The National Electric Code (NEC)
g. Installation procedures
h. Tools required
i. Operational checks

Provide Demonstration On:

a. Using NEC to determine requirements
b. Making wiring connections
c. Typical installations

Provide Practical Application On:

a. Installing cook top and vent
b. Determining size and type of wire, number of conductors and amperage rating of receptacle for a given cook top
c. Making operational checks

INSTRUCTIONAL MATERIALS

Textbooks:

a. Ruel and Nolte, Servicing Electrical Appliances, Vol. 2
b. Alerich, Electrical Construction Wiring
c. Mullin, Electrical-Wiring-Residential

A/Vs:

a. Georgia, "Installing Surface Unit and Hood," slide/tape MA-03a
b. AAVIM, "Electrical Wiring," slide/tape

Student Manuals:

a. Georgia, Major Appliances: Secondary, Unit MA-03
b. AAVIM, Electrical Wiring, 305SW

Tools and Equipment:

a. Shop tools
b. Various wire sizes and receptacles
c. Appliances
d. NEC manual
e. Local codes

LAB HOURS 6

CLASS HOURS 2

EVALUATION (AR-02)

a. Given an electric cook top, vent and a prepared counter surface and necessary tools and equipment, the student will determine correct wire specifications and install and wire the units in accordance with the National Electric Code and local codes.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

AR-03 Installing and wiring an electric oven

PERFORMANCE OBJECTIVE

Install and wire an electric wall oven.

INSTRUCTIONAL ACTIVITIES

Prerequisite Tasks:

EL-01 through EL-10, EL-22

Provide Information On:

a. Electrical safety
b. Uncrating and preparing the appliance
c. Determining electrical requirements
d. Using the power formula
e. The National Electric Code (NEC)
f. Installation procedures
g. Tools required
h. Operational checks

Provide Demonstration On:

a. Using NEC to determine requirements
b. Making wiring connections
c. Typical installation

Provide Practical Application On:

a. Determining size and type of wire, number of conductors and amperage rating of receptacle for a given wall oven
b. Installing and wiring the oven
c. Making operational checks

INSTRUCTIONAL MATERIALS

Textbooks:

a. Alerich, Electrical Construction Wiring
b. Mullin, Electrical Wiring-Residential

A/Vs:

a. Georgia, "Installing Oven," slide/tape MA-02a
b. AAVIM, "Electrical Wiring," slide/tape

Student Manuals:

a. Georgia, Major Appliances: Secondary, Unit MA-02
b. AAVIM, Electrical Wiring, Unit 305SW

Tools and Equipment:

a. Shop tools
b. Wire and receptacles
c. Wall oven
d. NEC manual
e. Local codes

LAB HOURS 6

CLASS HOURS 2

EVALUATION (AR-03)

a. Given an electric wall oven and necessary tools and equipment, the student will install and wire the oven in accordance with the National Electric Code and local codes.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

c. V'TECS, Appliance Repairer, Task No. 4.

TASK

AR-04 Installing and wiring an electric clothes dryer

PERFORMANCE OBJECTIVE

Install and wire an electric clothes dryer.

INSTRUCTIONAL ACTIVITIES

Prerequisite Tasks:

EL-01 through EL-10, EL-22

Provide Information On:

a. Electrical safety
b. Uncrating and preparing the appliance
c. Determining electrical requirements
d. Using the power formula
e. The National Electric Code (NEC)
f. Installation procedures
g. Tools required
h. Operational checks

Provide Demonstration On:

a. Using NEC to determine requirements
b. Making wiring connections
c. Typical installations

Provide Practical Application On:

a. Determining size and type of wire, number of conductors and amperage rating of receptacle for a given dryer

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INSTRUCTIONAL MATERIALS

Textbooks:

a. Ruel and Nolte, Servicing Electrical Appliances, Vol. 2
b. Alerich, Electrical Construction Wiring
c. Mullin, Electrical Wiring-Residential

A/Vs:

a. AAVIM, "Electrical Wiring," slide/tape AV-305
b. Whirlpool, "Washer and Dryer Installation," video tape

Student Manuals:

a. Georgia, Major Appliances: Secondary, Unit MA-04
b. AAVIM, Electrical Wiring, Unit 305SW

Tools and Equipment:

a. Shop tools
b. Wire and receptacles
c. Dryer
d. NEC manual
e. Local codes

LAB HOURS 6

CLASS HOURS 2

EVALUATION (AR-04)

a. Given an electric clothes dryer and necessary tools and equipment, the student will install and wire the dryer in accordance with the National Electric Code and local codes.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

c. V'TECS, Appliance Repairer, Task No. 2.

INSTRUCTIONAL ACTIVITIES

Provide Practical Application On:

b. Installing and wiring the dryer
c. Installing a pigtail
d. Making operational checks

TASK

AR-05 Installing and wiring an electric water heater

PERFORMANCE OBJECTIVE

Install, wire and plumb an electric water heater.

INSTRUCTIONAL ACTIVITIES

Prerequisite Tasks:

EL-01 through EL-10, EL-22

Provide Information On:

a. Electrical safety
b. Uncrating and preparing the appliance
c. Determining electrical requirements
d. Using the power formula
e. The National Electric Code (NEC)
f. Installation procedures
g. Tools required
h. Pressure vent
i. Operational checks

Provide Demonstration On:

a. Using NEC to determine requirements
b. Making wiring connections
c. Typical installation
d. Proper water hook-up

Provide Practical Application On:

a. Determining size and type of wire, number of conductors and amperage

(Continued on back)

INSTRUCTIONAL MATERIALS

Textbooks:

a. Ruel and Nolte, Servicing Electrical Appliances, Vol. 1
b. Mullin, Electrical Wiring-Residential

A/Vs:

AAVIM, "Electrical Wiring," slide/tape AV-305

Student Manuals:

AAVIM, Electrical Wiring, Unit 305SW

Tools and Equipment:

a. Shop tools
b. Wire and receptacles
c. Water heater
d. NEC manual
e. Local codes
f. Copper pipe and soldering equipment (or PVC)

LAB HOURS	6
CLASS HOURS	2

EVALUATION (AR-05)

a. Given an electric water heater and necessary tools and equipment, the student will install, plumb and wire the heater in accordance with the National Electric Code and local codes.

b. Review questions in Ruel and Nolte.

c. V'TECS, Appliance Repairer, Task No. 10.

INSTRUCTIONAL ACTIVITIES

Provide Practical Application On:

b. Making the necessary water hook-ups
c. Installing and wiring unit
d. Performing operational checks

TASK

AR-06 Installing and wiring a microwave oven

PERFORMANCE OBJECTIVE

Install and wire a microwave oven.

INSTRUCTIONAL ACTIVITIES

Prerequisite Tasks:

EL-01 through EL-11, EL-20

Provide Information On:

a. Electrical safety
b. Uncrating and preparing the appliance
c. Determining electrical requirements
d. Using the power formula
e. The National Electric Code (NEC)
f. Installation procedures
g. Tools required
h. Operational checks

Provide Demonstration On:

a. Using NEC to determine requirements
b. Making wiring connections
c. Typical installations

Provide Practical Application On:

a. Determining size and type of wire, number of conductors and amperage rating of receptacle for a given microwave oven
b. Installing and wiring unit
c. Performing operational checks

INSTRUCTIONAL MATERIALS

Textbooks:

a. Mix, Housewiring Simplified
b. Mullin, Electrical Wiring-Residential

A/Vs:

AAVIM, "Electrical Wiring, slide/tape

Student Manuals:

AAVIM, Electrical Wiring, Unit 305SW

Tools and Equipment:

a. Shop tools
b. Various wire sizes and receptacles
c. Microwave oven
d. NEC manual
e. Local codes

LAB HOURS 6
CLASS HOURS 2

EVALUATION (AR-06)

Given a microwave oven and necessary tools and equipment, the student will determine correct wire specifications and install and wire the oven in accordance with the National Electric Code and local codes.

TASK

AR-07 Installing and wiring a refrigerator or freezer

PERFORMANCE OBJECTIVE

Install and wire a refrigerator or freezer.

INSTRUCTIONAL ACTIVITIES

Prerequisite Tasks:

EL-01 through EL-10, EL-20

Provide Information On:

a. Electrical safety
b. Uncrating and preparing the appliance
c. Determining electrical requirements
d. Using the power formula
e. The National Electric Code (NEC)
f. Installation procedures
g. Tools required
h. Operational checks

Provide Demonstration On:

a. Using NEC to determine requirements
b. Making wiring connections
c. Typical installations

Provide Practical Application On:

a. Determining size and type of wire, number of conductors and amperage rating of receptacle for a given refrigerator or freezer
b. Installing and wiring appliances
c. Leveling appliances
d. Performing operational checks

INSTRUCTIONAL MATERIALS

Textbooks:

Mullin, Electrical Wiring-Residential

A/Vs:

a. Georgia, "Transporting Major Appliances," slide/ tape MA-09a
b. AAVIM, "Electrical Wiring," slide/tape

Student Manuals:

a. Georgia, Major Appliances: Secondary, Units MA-08, MA-09
b. AAVIM, Electrical Wiring, Unit 305SW

Tools and Equipment:

(Continued on back)

LAB HOURS	6
CLASS HOURS	2

EVALUATION (AR-07)

a. Given a refrigerator and necessary tools and equipment, the student will determine correct wire specifications and install and wire the refrigerator in accordance with the National Electric Code and local codes.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

c. V'TECS, Appliance Repairer, Task No. 2.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

a. Shop tools
b. Various wire sizes and receptacles
c. Refrigerator
d. NEC manual
e. Local codes

TASK

AR-08 Installing an icemaker

PERFORMANCE OBJECTIVE

Install and hook-up an icemaker kit into a refrigerator.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. How the icemaker works
b. Safety precautions
c. Operation conditions
d. Installation instructions
e. List of tools
f. Operational checks

Provide Demonstration On:

Typical installation

Provide Practical Application On:

Having student install an icemaker kit and perform an operational check

INSTRUCTIONAL MATERIALS

Textbooks:

Althouse, Modern Refrigeration and Air Conditioning

Tools and Equipment:

a. Shop tools
b. Icemaker kit
c. Tubing materials
d. Manufacturer's instructions

LAB HOURS	6
CLASS HOURS	2

EVALUATION (AR-08)

a. Given an operational refrigerator, icemaker kit and necessary tools, the student will install the icemaker to manufacturer's specifications. No visible water leaks are allowed.

b. V'TECS, Appliance Repairer, Task No. 9.

TASK

AR-09 Installing and wiring a trash compactor

PERFORMANCE OBJECTIVE

Install and wire a trash compactor.

INSTRUCTIONAL ACTIVITIES

Prerequisite Tasks:

EL-01 through EL-10, EL-20

Provide Information On:

a. Electrical and mechanical safety
b. Uncrating and preparing appliance
c. Determining electrical requirements
d. Using the power formula
e. *The National Electric Code* (NEC)
f. Installation procedures
g. Tools required
h. Operational checks

Provide Demonstration On:

a. Using *NEC* to determine requirements
b. Making wiring connections
c. Typical installations

Provide Practical Application On:

a. Determining size and type of wire, number of conductors and amperage rating of a receptacle for a given trash compactor
b. Installing and wiring the compactor
c. Performing operational checks

INSTRUCTIONAL MATERIALS

Textbooks:

a. Ruel and Nolte, *Servicing Electrical Appliances*, Vol. 2
b. Mullin, *Electrical Wiring-Residential*

A/Vs:

AAVIM, "Electrical Wiring," slide/tape

Student Manuals:

AAVIM, *Electrical Wiring*, Unit 305SW

Tools and Equipment:

a. Shop tools
b. Various wire sizes and receptacles
c. Appliances
d. *NEC* manual
e. Local codes
f. Manufacturer's instructions

LAB HOURS 4

CLASS HOURS 2

EVALUATION (AR-09)

a. Given a trash compactor and necessary tools and equipment, the student will install and wire the compactor in accordance with the National Electric Code and local codes.

b. Review questions in Ruel and Nolte.

TASK

AR-10 Installing and wiring a dishwasher

PERFORMANCE OBJECTIVE

Install, wire and plumb a dishwasher.

INSTRUCTIONAL ACTIVITIES

Prerequisite Tasks:

EL-01 through EL-10

Provide Information On:

a. Electrical safety
b. Uncrating and preparing the appliance
c. Determining electrical requirements
d. Using the power formula
e. *The National Electric Code* (NEC)
f. Installation procedures
g. Plumbing procedures
h. Tools required
i. Operational checks

Provide Demonstration On:

a. Using *NEC* to determine requirements
b. Making wiring connections
c. Typical installations

Provide Practical Application On:

a. Determining size and type of wire, number of conductors and amperage rating of receptacle for a given dishwasher
b. Installing necessary plumbing
c. Installing wiring
d. Performing operational checks

INSTRUCTIONAL MATERIALS

Textbooks:

a. Ruel and Nolte, *Servicing Electrical Appliances*, Vol. 2
b. Mullin, *Electrical Wiring-Residential*

A/Vs:

AAVIM, "Electrical Wiring," slide/tape

Student Manuals:

a. Georgia, *Major Appliances: Secondary*, Unit MA-06
b. AAVIM, *Electrical Wiring*, Unit 305SW

Tools and Equipment:

(Continued on back)

LAB HOURS 16

CLASS HOURS 4

EVALUATION (AR-10)

a. Given a dishwasher and necessary tools and equipment, the student will determine correct wire specifications and install, wire and plumb the dishwasher in accordance with the National Electrical Code and local codes. No visible water leaks are allowed.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

c. V'TECS, Appliance Repairer, Task No. 3.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

a. Shop tools
b. Various wire sizes and receptacles
c. Dishwasher
d. NEC manual
e. Local codes
f. Plumbing equipment
g. Manufacturer's installation instructions

TASK

AR-11 Installing, plumbing and wiring a clothes washer

PERFORMANCE OBJECTIVE

Install, plumb and wire a washing machine.

INSTRUCTIONAL ACTIVITIES

Prerequisite Tasks:

EL-01 through EL-10

Provide Information On:

a. Electrical safety
b. Uncrating and preparing the appliance
c. Determining electrical requirements
d. Using the power formula
e. The National Electric Code (NEC)
f. Installation procedures
g. Plumbing procedures
h. Tools required
i. Operational checks

Provide Demonstration On

a. Using NEC to determine requirements
b. Making wiring connections
c. Typical installations

Provide Practical Application On:

a. Determining size and type of wire, number of conductors and amperage rating of receptacle for a given clothes washer
b. Installing necessary plumbing
c. Installing wiring
d. Performing operational checks

INSTRUCTIONAL MATERIALS

Textbooks:

a. Ruel and Nolte, Servicing Electrical Appliances, Vol. 2
b. Mullin, Electrical Wiring-Residential

A/Vs:

a. AAVIM, "Electrical Wiring," slide/tape
b. Whirlpool, "Washer and Dryer Installation," video tape

Student Manuals:

a. Georgia, Major Appliances: Secondary, Unit MA-05
b. AAVIM, Electrical Wiring, Unit 305SW

Tools and Equipment:

(Continued on back)

LAB HOURS	8
CLASS HOURS	2

EVALUATION (AR-11)

a. Given a clothes washer and necessary tools and equipment, the student will determine correct wire specifications and install, wire and plumb the washer in accordance with the National Electric Code and local codes. No water leaks are allowed.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

c. V'TECS, Appliance Repairer, Task No. 2.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

a. Shop tools
b. Various wire sizes
c. Clothes washer
d. NEC manual
e. Local codes
f. Plumbing equipment
g. Manufacturer's installation instructions

TASK

AR-12 Installing and plumbing a gas range

PERFORMANCE OBJECTIVE

Run piping and install a gas range.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Natural gas properties
b. Safety
c. The National Fuel Gas Code
d. Uncrating and preparing the appliance
e. Piping and fittings
f. Plumbing procedures
g. Tools required
h. Operational checks

Provide Demonstration On:

a. Proper gas piping installation
b. Interpreting the National Fuel Gas Code
c. Final checks

Provide Practical Application On:

a. Installing gas piping and hooking up stove
b. Performing operational checks

INSTRUCTIONAL MATERIALS

Textbooks:

a. National Training Aids, Cooking Service Training Manual
b. Oravetz, Plumbers and Pipefitters Library

A/Vs:

Georgia, "Applying Gas Fuel Combustion and Safety Principles," slide/tape HE-04a; "Transporting Major Appliances," MA-09a; "Gas Piping Principles," slide/tape HE-07a

Student Manuals:

Georgia, Heating: Post Secondary, Units HE-04, HE-07; Georgia, Major Appliances: Secondary, Unit MA-09

Tools and Equipment:

a. National Fuel Gas Code manual
b. Local codes
c. Gas range
d. Piping materials and tools

LAB HOURS 14

CLASS HOURS 6

EVALUATION (AR-12)

a. Given a gas range and necessary tools and equipment, the student will run piping, install and check out the stove for proper operation. No gas leaks are permitted and all work must conform to the National Fuel Gas Code and local codes.

b. Georgia, Heating and Air Conditioning, Instructor Guide, Vol. IV, 1980.

TASK

AR-13 Installing and plumbing a gas oven

PERFORMANCE OBJECTIVE

Run piping and install a gas wall oven.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Natural gas properties
b. Safety
c. The National Fuel Gas Code
d. Uncrating and preparing the appliance
e. Piping and fittings
f. Plumbing procedures
g. Tools required
h. Operational checks

Provide Demonstration On:

a. Proper gas piping installation
b. Interpreting the National Fuel Gas Code
c. Final checks

Provide Practical Application On:

a. Installing gas piping and hooking up the oven
b. Performing operational checks

INSTRUCTIONAL MATERIALS

Textbooks:

a. National Training Aids, Cooking Service Training Manual
b. Oravetz, Plumbers and Pipefitters Library

A/Vs:

Georgia, "Applying Gas Fuel Combustion and Safety Principles," slide/tape HE-04a; "Gas Piping Principles," slide/tape HE-07a

Student Manuals:

Georgia, Heating: Post Secondary, Units HE-04 and HE-07

Tools and Equipment:

a. National Fuel Gas Code
b. Local codes
c. Gas wall oven
d. Piping materials and tools

LAB HOURS	16
CLASS HOURS	4

EVALUATION (AR-13)

a. Given a gas oven and necessary tools and equipment, the student will run piping and install and check out the oven for proper operation. No gas leaks are permitted and all work must conform to the National Fuel Gas Code and local codes.

b. Georgia, Heating and Air Conditioning, Instructor Guide, Vol. IV, 1980.

c. V'TECS, Appliance Repairer, Task No. 7.

TASK

AR-14 Installing and plumbing a gas clothes dryer

PERFORMANCE OBJECTIVE

Run piping and install a gas dryer.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Natural gas properties
b. Safety
c. The National Fuel Gas Code
d. Uncrating and preparing the appliance
e. Piping and fittings
f. Plumbing procedures
g. Tools required
h. Operational checks

Provide Demonstration On:

a. Proper gas piping installation
b. Interpreting the National Fuel Gas Code
c. Final checks

Provide Practical Application On:

a. Installing gas piping and hooking up the dryer
b. Performing operational checks

INSTRUCTIONAL MATERIALS

Textbooks:

Oravetz, Plumbers and Pipefitters Library

A/Vs:

Georgia, "Applying Gas Fuel Combustion and Safety Principles," slide/tape HE-04a; "Gas Piping Principles," slide/tape HE-07a

Student Manuals:

Georgia, Heating: Post Secondary, Units HE-04a and HE-07

Tools and Equipment:

a. National Fuel Gas Code
b. Local codes
c. Gas dryer
d. Piping materials and tools

LAB HOURS 16

CLASS HOURS 4

EVALUATION (AR-14)

a. Given a gas clothes dryer and necessary tools and equipment, the student will run piping and install and check out the dryer for proper operation. No gas leaks are permitted and all work must conform to the National Fuel Gas Code and local codes.

b. Georgia, Heating and Air Conditioning, Instructor Guide, Vol. IV, 1980.

TASK

AR-15 Installing and plumbing a gas water heater

PERFORMANCE OBJECTIVE

Run gas and water piping and install water heater.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Natural gas properties
b. Safety
c. The National Fuel Gas Code
d. Uncrating and preparing the appliance
e. Piping and fittings
f. Plumbing procedures
g. Tools required
h. Operational checks

Provide Demonstration On:

a. Proper gas piping installation
b. Interpreting the National Fuel Gas Code
c. Performing operational checks

Provide Practical Application On:

a. Installing gas piping and hooking up water heater
b. Installing water piping
c. Performing operational checks

INSTRUCTIONAL MATERIALS

Textbooks:

a. National Training Aids, Water Heating Service Training Manual
b. Oravetz, Plumbers and Pipefitters Library
c. Slater and Smith, Basic Plumbing

A/Vs:

Georgia, "Applying Gas Fuel Combustion and Safety Principles," slide/tape HE-04a; "Gas Piping Principles," slide/tape HE-07a

Student Manuals:

Georgia, Heating: Post Secondary, Units HE-04 and HE-07

Tools and Equipment:

a. National Fuel Gas Code manual
b. Local codes
c. Gas range
d. Piping materials and tools

LAB HOURS	16
CLASS HOURS	4

EVALUATION (AR-15)

a. Given a gas water heater and necessary tools and equipment, the student will run gas and water piping and install and check out the water heater for proper operation. No gas or water leaks are permitted and all work must conform to the National Fuel Gas Code and local codes.

b. Georgia, Heating and Air Conditioning, Instructor Guide, Vol. IV, 1980.

TASK

AR-16 Installing and plumbing a gas space heater

PERFORMANCE OBJECTIVE

Run gas piping and install an unvented space heater.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Vented and unvented space heaters
b. Heater placement
c. Natural gas properties
d. Safety
e. The National Fuel Gas Code
f. Uncrating and preparing the appliance
g. Piping and fittings
h. Plumbing procedures
i. Tools required
j. Operational checks

Provide Demonstration On:

a. Proper gas piping installation
b. Interpreting the National Fuel Gas Code
c. Final checks

Provide Practical Application On:

a. Installing gas piping and hooking up the heater
b. Performing operational checks

INSTRUCTIONAL MATERIALS

Textbooks:

a. National Training Aids, Heating Service Training Manual
b. Oravetz, Plumbers and Pipefitters Library

A/Vs:

Georgia, "Applying Gas Fuel Combustion and Safety Principles," slide/tape HE-04a; "Gas Piping Principles," slide/tape HE-07a

Student Manuals:

Georgia, Heating: Post Secondary, Units HE-04a and HE-07

Tools and Equipment:

a. National Fuel Gas Code
b. Local codes
c. Unvented gas space heaters
d. Piping materials and tools

LAB HOURS	16
CLASS HOURS	4

EVALUATION (AR-16)

a. Given a gas space heater and necessary tools and equipment, the student will run piping and install and check out the heater for proper operation. No gas leaks are permitted and all work must conform to the National Fuel Gas Code and local codes.

b. Georgia, Heating and Air Conditioning, Instructor Guide, Vol. IV, 1980.

TASK

AR-17 Installing an outdoor gas grill

PERFORMANCE OBJECTIVE

Run piping and install an outdoor gas grill.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Gas grill characteristics
b. Natural gas properties
c. Safety
d. The National Fuel Gas Code
e. Uncrating and preparing the appliance
f. Piping and fittings
g. Plumbing procedures
h. Tools required
i. Operational checks

Provide Demonstration On:

a. Proper gas piping installation
b. Interpreting the National Fuel Gas Code
c. Final checks

Provide Practical Application On:

a. Installing gas piping and hooking up the grill
b. Performing operational checks

INSTRUCTIONAL MATERIALS

Textbooks:

Oravetz, Plumbers and Pipefitters Library

A/Vs:

Georgia, "Applying Gas Fuel Combustion and Safety Principles," slide/tape HE-04a; "Gas Piping Principles," slide/tape HE-07a

Student Manuals:

Georgia, Heating: Post Secondary, Units HE-04a and HE-07

Tools and Equipment:

a. National Fuel Gas Code manual
b. Local codes
c. Outdoor gas grill
d. Piping materials and tools

LAB HOURS	10
CLASS HOURS	4

EVALUATION (AR-17)

a. Given an outdoor gas grill and necessary tools and equipment, the student will run piping and install and check out the dryer for proper operation. No gas leaks are permitted and all work must conform to the National Fuel Gas Code and local codes.

b. Georgia, Heating and Air Conditioning, Instructor Guide, Vol. IV, 1980.

TASK

AR-18 Installing a gas appliance vent

PERFORMANCE OBJECTIVE

Calculate size and install a gas appliance vent.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Purpose and operation of vent
b. Safety precautions
c. The National Fuel Gas Code
d. Combustion grills
e. Tool list

Provide Demonstration On:

a. Interpreting the National Fuel Gas Code
b. Typical installation

Provide Practical Application On:

a. Calculating vent requirements
b. Installing an appliance vent

INSTRUCTIONAL MATERIALS

Textbooks:

a. Metalbestos, Gas Vent and Chimney Sizing Handbook
b. National Training Aids, Gas Water Heating, Cooking and Heating

Student Manuals:

Georgia, Heating: Post Secondary, Unit HE-14

Tools and Equipment:

a. Shop tools
b. Venting pipe and materials
c. Sizing charts
d. National Fuel Gas Code manual

LAB HOURS 10

CLASS HOURS 4

EVALUATION (AR-18)

a. Given an installed gas appliance and necessary tools and equipment, the student will install a vent of correct specifications in accordance with the National Fuel Gas Code.

b. Georgia, Heating and Air Conditioning, Instructor Guide, Vol. IV, 1980.

TASK

AR-19 Testing electronic circuitry

PERFORMANCE OBJECTIVE

Perform basic function tests of electronic appliance circuits.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Semi-conductor materials
  1. Germanium
  2. Silicon
b. Transistors
c. Diodes
d. Printed circuitry
e. Integrated circuitry
f. Resistors
g. Capacitors
h. Light Emitting Diodes (LED)
i. Digital components
j. Touch panels
k. Manufacturer's test equipment

Provide Demonstration On:

Testing circuitry using manufacturer's test equipment

Provide Practical Application On:

Locating a circuit problem in an appliance with electronic circuitry

INSTRUCTIONAL MATERIALS

Textbooks:

Whirlpool, Electronics for Appliances

Student Manuals:

Whirlpool, Electronics for Appliances

Tools and Equipment:

a. Various circuit mock-ups
b. Appliance with electronic circuitry
c. VOM meter
d. Manufacturer's test equipment

LAB HOURS 8

CLASS HOURS 5

EVALUATION (AR-19)

a. Given an appliance with faulty electronic circuitry and necessary tools and equipment, the student will locate the problem and remove and replace the defective component. The appliance must operate according to manufacturer's specifications and work must meet given specifications.

b. V'TECS, Appliance Repairer, Task No. 15, 33, 38, 48, 49, 50.

TASK

AR-20 Testing and replacing surface units and oven heating elements

PERFORMANCE OBJECTIVE

Test and replace defective surface unit and even heating elements.

INSTRUCTIONAL ACTIVITIES

Prerequisite Tasks:

EL-03 through EL-06

Provide Information On:

a. Safety precautions
b. Element description and function
c. Testing the element
d. Removal procedures
e. Tool list

Provide Demonstration On:

a. Testing the element
b. Removing the element

Provide Practical Application On:

a. Testing all surface unit elements
b. Testing oven unit element
c. Replacing any defective element found

INSTRUCTIONAL MATERIALS

Textbooks:

a. Ruel and Nolte, Servicing Electrical Appliances, Vol. 1
b. Whirlpool, Range Service

A/Vs:

Georgia, "Test and Replace a Surface Unit Element," slide/tape MA-26a

Student Manuals:

a. Georgia, Major Appliances: Secondary, Units MA-26, MA-28
b. Whirlpool, Range Service, Electric

Tools and Equipment:

a. VOM meter
b. Several different styles and types of elements
c. Shop manual

LAB HOURS	6
CLASS HOURS	4

EVALUATION (AR-20)

a. Given an electric range and necessary tools and equipment, the student will test each element and record the information. All defective elements must be identified. The defective element must be replaced to conform with manufacturer's specifications.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

c. Review questions in Ruel and Nolte.

d. V'TECS, Appliance Repairer, Task No. 46.

TASK

AR-21 Testing and replacing surface unit and oven temperature control switches and thermostats

PERFORMANCE OBJECTIVE

Test and replace defective surface unit and oven controls.

INSTRUCTIONAL ACTIVITIES

Prerequisite Tasks:

EL-03 through EL-06

Provide Information On:

a. Safety precautions
b. Thermostat function
c. Switch function
d. Types of switches
e. Electrical connections
f. Tools
g. Adjusting oven thermostats

Provide Demonstration On:

a. Electrical connections
b. Testing procedures

Provide Practical Application On:

a. Testing all surface unit switches and thermostats if used
b. Testing oven control switches and thermostat
c. Adjusting an oven thermostat

INSTRUCTIONAL MATERIALS

Textbooks:

a. Ruel and Nolte, Servicing Electrical Appliances, Vol. 1
b. Whirlpool, Range Service

Student Manuals:

a. Georgia, Major Appliances: Secondary, Units MA-27, MA-29
b. Whirlpool, Range Service, Electric

Tools and Equipment:

a. Shop tools
b. Assortment of switches and thermostats
c. VOM meter

(Continued on back)

LAB HOURS 8

CLASS HOURS 4

EVALUATION (AR-21)

a. Given an electric range and necessary tools and equipment, the student will test each switch and the oven thermostat and record the information. All defective switches and thermostats must be identified. The defective switch and/or thermostat must be replaced to conform with manufacturer's specifications.

b. Georgia, Electro-Mechanical Program, Instructor Guide, Vol. IV.

c. Review questions in Ruel and Nolte.

d. V'TECS, Appliance Repairer, Nos. 11, 14, 15, 18, 20, 23.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

d. Shop manual
e. Thermometer

TASK

AR-22 Testing and replacing the oven timer

PERFORMANCE OBJECTIVE

Test and replace defective oven timers.

INSTRUCTIONAL ACTIVITIES

Prerequisite Tasks:

EL-03 through EL-06

Provide Information On:

a. Safety precautions
b. Timer function
c. Purpose of service timer
d. Types of timers
e. Checking contact points
f. Tools needed

Provide Demonstration On:

a. Checking contact points
b. Testing procedures

Provide Practical Application On:

Testing and replacing the timer

INSTRUCTIONAL MATERIALS

Textbooks:

a. Ruel and Nolte, Servicing Electrical Appliances, Vol. 1
b. Whirlpool, Range Service

Student Manuals:

a. Georgia, Major Appliances: Secondary, Unit MA-30
b. Whirlpool, Range Service, Electric

Tools and Equipment:

a. Shop tools
b. Assortment of timers
c. VOM meter
d. Shop manual

LAB HOURS 8
CLASS HOURS 4

EVALUATION (AR-22)

a. Given an electric range with defective timer and necessary tools and equipment, the student will test the timer and record the information. The timer must be replaced to conform with manufacturer's specifications. All recorded information must be equal to known values.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

c. Review questions in Ruel and Nolte.

d. V'TECS, Appliance Repairer, Task Nos. 14, 21.

TASK

AR-23 Testing and replacing ceramic cook tops

PERFORMANCE OBJECTIVE

Inspect, test and replace a ceramic cook top.

INSTRUCTIONAL ACTIVITIES

Prerequisite Tasks:

EL-03 through EL-06

Provide Information On:

a. Characteristics of ceramic cook tops
b. Comparison of ceramic to conventional heating eyes
c. Heating elements
d. Temperature control
e. Testing precautions
f. Removing and reinstalling

Provide Demonstration On:

a. Removing and replacing ceramic
b. Testing and replacing heating elements

Provide Practical Application On:

Testing, removing and replacing a ceramic cook top

INSTRUCTIONAL MATERIALS

Textbooks:

Whirlpool, Range Service

Student Manuals:

Whirlpool, Range Service, Electric

Tools and Equipment:

a. Range with ceramic cook top
b. Built in cook top
c. Test equipment
d. Hand tools

LAB HOURS 8
CLASS HOURS 4

EVALUATION (AR-23)

Given a ceramic cook top with a faulty heating element and necessary tools and equipment, the student will locate the problem and repair it. The cook top must operate within the manufacturer's specifications. All work must conform to given requirements.

TASK

AR-24 Troubleshooting microwave ovens

PERFORMANCE OBJECTIVE

Troubleshoot and repair microwave ovens.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Microwave theory
b. Oven components
c. Magnetron tubes
d. Door locks
e. Cabinets
f. Cabinet interior
g. Lighting
h. Controls
i. Timers
j. Temperature probes
k. Manufacturer's test equipment

Provide Demonstration On:

a. Testing microwave components
b. Replacing components

Provide Practical Application On:

Testing and replacing microwave oven components

INSTRUCTIONAL MATERIALS

Textbooks:

a. Whirlpool, Range Service
b. Whirlpool, Electronics for Appliances

Student Manuals:

a. Whirlpool, Range Service, Microwave
b. Whirlpool, Electronics for Appliances

Tools and Equipment:

a. Microwave oven
b. Microwave components
c. Manufacturer's test equipment
d. VOM

LAB HOURS	8
CLASS HOURS	4

EVALUATION (AR-24)

a. Given a defective microwave oven and necessary tools and equipment, the student will locate the problem and repair as needed. Microwave must function according to manufacturer's specifications and all work must meet given requirements.

b. V'TECS, Appliance Repairer, Task Nos. 30, 85, 86, 87, 88, 93.

TASK

AR-25 Servicing electric dryer mechanical systems

PERFORMANCE OBJECTIVE

Identify components and troubleshoot the mechanical system of an automatic clothes dryer.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Component identification
b. Visual inspection
c. Belt function and inspection
d. Drum inspection
e. Air leaks

Provide Demonstration On:

a. Replacing belt
b. Replacing drum
c. Adjusting door

Provide Practical Application On:

a. Inspecting and replacing belt and drum
b. Adjusting door

INSTRUCTIONAL MATERIALS

Textbooks:

a. Ruel and Nolte, Servicing Electrical Appliances, Vol. 2
b. Whirlpool, Automatic Dryers

Student Manuals:

a. Georgia, Major Appliances: Secondary, Unit MA-16
b. Whirlpool, Automatic Dryers, Electric

Tools and Equipment:

a. Dryer with back removed
b. Belts and drums
c. Shop manual

LAB HOURS	8
CLASS HOURS	4

EVALUATION (AR-25)

a. Given an automatic clothes dryer and necessary tools and equipment, the student will replace the belt and drum. All work must conform to manufacturer's specifications.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

c. Review questions in Ruel and Nolte.

d. V'TECS, Appliance Repairer, Task No. 69.

TASK

AR-26 Servicing dryer electrical systems

PERFORMANCE OBJECTIVE

Identify components and troubleshoot the electrical system of an electric clothes dryer.

INSTRUCTIONAL ACTIVITIES

Prerequisite Tasks:

EL-01 through EL-07, EL-18

Provide Information On:

a. The motor, timer, thermostats, heating element and door switch
b. Testing and inspecting for serviceability

Provide Demonstration On:

a. Testing motor
b. Testing thermostat
c. Testing element
d. Testing door switch

Provide Practical Application On:

Testing, removing and replacing the motor, timer, thermostats, heating element and door switch

INSTRUCTIONAL MATERIALS

Textbooks:

a. Ruel and Nolte, Servicing Electrical Appliances, Vol. 2
b. Whirlpool, Automatic Dryers

A/Vs:

Georgia, "Servicing Dryer Electrical System," slide/tape MA-17a and MA-17b

Student Manuals:

a. Georgia, Major Appliances: Secondary, Unit MA-17
b. Whirlpool, Automatic Dryers, Electric

Tools and Equipment:

a. Shop tools
b. VOM
c. Assortment of motors, switches, thermostats, elements and timers
d. Shop manual

LAB HOURS	8
CLASS HOURS	4

EVALUATION (AR-26)

a. Given an automatic electric clothes dryer and necessary tools and equipment, the student will test and replace the motor, timer, thermostats, heating element and door switch. All work must conform to manufacturer's specifications.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

c. V'TECS, Appliance Repairer, Task Nos. 19, 20, 34, 90.

TASK

AR-27 Testing and replacing electric water heater elements

PERFORMANCE OBJECTIVE

Test, remove and replace the electric water heating elements.

INSTRUCTIONAL ACTIVITIES

Prerequisite Tasks:

EL-03 through EL-06a

Provide Information On:

a. Types of water heaters (conventional, cabinet)
b. Capacity of water heaters
c. Number and type of elements used (immersion, external)
d. Thermostats
e. Circuits (duplex, load-limiting)
f. Color coding
g. Model and serial number coding
h. Relief valves
i. Checking the element
j. Draining the unit replacing the element

Provide Demonstration On:

a. Troubleshooting element burnout
b. Replacing the element

Provide Practical Application On:

a. Making a determination if the element is defective
b. Replacing the element

INSTRUCTIONAL MATERIALS

Textbooks:

Ruel and Nolte, Servicing Electrical Applicances, Vol. 1

Tools and Equipment:

a. VOM meter
b. Various heating element styles
c. Cut-a-way of two element heater
d. Hand tools

LAB HOURS	8
CLASS HOURS	4

EVALUATION (AR-27)

a. Given a water heater with a defective heating element and necessary tools and equipment, the student will locate the problem and remove and replace the element according to the manufacturer's specifications. Upon completion, the water heater must function properly with no water leakage.

b. Review questions in Ruel and Nolte.

c. V'TECS, Appliance Repairer, Task No. 40.

TASK

AR-28 Testing and replacing electric water heater thermostats

PERFORMANCE OBJECTIVE

Test, remove and replace the electric water heater thermostat(s).

INSTRUCTIONAL ACTIVITIES

Prerequisite Tasks:

EL-03 through EL-06

Provide Information On:

a. Number and type of thermostats used (immersion, external)
b. Thermostat construction
c. Circuits (duplex, load-limiting)
d. Color coding
e. Model and serial number coding
f. Adjusting the thermostat

Provide Demonstration On:

a. Troubleshooting thermostat problems with VOM
b. Replacing the thermostat

Provide Practical Application On:

a. Determining if the element or thermostat is defective
b. Replacing and adjusting the thermostat

INSTRUCTIONAL MATERIALS

Textbooks:

Ruel and Nolte, Servicing Electrical Appliances, Vol. 1

Tools and Equipment:

a. VOM meter
b. Various thermostat styles
c. Cut-a-way of two element heater
d. Hand tools

LAB HOURS	8
CLASS HOURS	4

EVALUATION (AR-28)

a. Given a water heater with a defective thermostat and necessary tools and equipment, the student will locate the problem and remove and replace the thermostat according to the manufacturer's specifications. Upon completion, the water heater must function properly with no water leakage.

b. Review questions in Ruel and Nolte.

c. V'TECS, Appliance Repairer, Task No. 20.

TASK

AR-29 Testing and replacing the dishwasher timer and solenoids

PERFORMANCE OBJECTIVE

Test, remove and replace the dishwasher timer and solenoids.

INSTRUCTIONAL ACTIVITIES

Prerequisite Tasks:

EL-03 through EL-07

Provide Information On:

a. Function of timer
b. Timer motor
c. Timer contacts
d. Testing the timer
e. Function and operation of solenoids
f. Solenoids found on dishwashers
g. Testing the solenoid
h. Interaction of timer and solenoids
i. Wiring schematic

Provide Demonstration On:

a. Testing and replacing timer
b. Testing and replacing solenoids

Provide Practical Application On:

Having the student test, remove and replace the timer, fin valve solenoid and dispenser solenoid(s)

INSTRUCTIONAL MATERIALS

Textbooks:

a. Ruel and Nolte, *Servicing Electrical Appliances*, Vol. 2
b. Whirlpool, *Dishwashers, Trash Mashers and Disposers*

Student Manuals:

Georgia, *Major Appliances: Secondary*, Units MA-18, MA-21 MA-24

Tools and Equipment:

a. VOM meter
b. Hand tools
c. Timers and solenoids
d. Dishwasher
e. Wiring schematics
f. Shop manual

LAB HOURS 10

CLASS HOURS 5

EVALUATION (AR-29)

a. Given an automatic dishwasher and necessary tools and equipment, the student will test and replace the timer and fill valve solenoid and dispenser solenoid. Useability of timer and solenoid must be determined. Installation of parts must be within manufacturer's specifications and the machine must operate as intended by the manufacturer.

b. Review questions in Ruel and Nolte.

c. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

d. V'TECS, Appliance Repairer, Task No. 45.

TASK

AR-30 Testing and replacing dishwasher level control and door switches

PERFORMANCE OBJECTIVE

Test, remove and replace the water level control and door switches.

INSTRUCTIONAL ACTIVITIES

Prerequisite Tasks:

EL-01 through EL-07

Provide Information On:

a. Location and description of switches
b. Testing the switches
c. Interaction of timer and switches

Provide Demonstration On:

Testing the switches

Provide Practical Application On:

Testing, removing and replacing the water level control switch and door switch

INSTRUCTIONAL MATERIALS

Textbooks:

a. Ruel and Nolte, Servicing Electrical Appliances, Vol. 2
b. Whirlpool, Dishwashers, Trash Mashers and Diposers

Student Manuals:

Georgia, Major Appliances: Secondary, Unit MA-19

Tools and Equipment:

a. VOM meter
b. Hand tools
c. Switches
d. Dishwasher
e. Wiring schematic
f. Shop manual

LAB HOURS 8

CLASS HOURS 2

EVALUATION (AR-30)

a. Given an automatic dishwasher and necessary tools and equipment, the student will test and replace the water level control and door switch. Installation of the parts must be within manufacturer's specifications and the machine must operate as intended by the manufacturer.

b. Review questions in Ruel and Nolte.

c. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

d. V'TECS, Appliance Repairer, Task No. 19.

TASK

AR-31 Testing and replacing the dishwasher heating element and thermostat

PERFORMANCE OBJECTIVE

Test, remove and replace the heating element and thermostat.

INSTRUCTIONAL ACTIVITIES

Prerequisite Tasks:

EL-03 through EL-06

Provide Information On:

a. Location and description of heating element and thermostat
b. Testing the element and thermostat
c. Interaction of timer thermostat and element

Provide Demonstration On:

Testing element and thermostat

Provide Practical Application On:

Testing, removing and replacing heat element and thermostat

INSTRUCTIONAL MATERIALS

Textbooks:

a. Ruel and Nolte, Servicing Electrical Appliances, Vol. 2
b. Whirlpool, Dishwashers, Trash Mashers and Disposers

Student Manuals:

Georgia, Major Appliances: Secondary, Unit MA-20

Tools and Equipment:

a. VOM meter
b. Hand tools
c. Elements and thermostats
d. Dishwasher
e. Wiring schematic
g. Shop manual

LAB HOURS	8
CLASS HOURS	2

EVALUATION (AR-31)

a. Given an automatic dishwasher and necessary tools and equipment, the student will test and replace heating element and thermostat. Installation of the parts must be within manufacturer's specifications and the machine must operate as intended by the manufacturer.

b. Review questions in Ruel and Nolte.

c. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

d. V'TECS, Appliance Repairer, Task Nos. 20, 40.

TASK

AR-32 Testing and replacing the dishwasher automatic dispenser

PERFORMANCE OBJECTIVE

Test, remove and replace the soap dispenser and the wetting agent dispenser.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Operation (bi-metal or linkage)
b. Purpose of timed dispensing
c. Interaction of timer and dispenser

Provide Demonstration On:

Testing the dispenser operation

Provide Practical Application On:

Testing, removing and replacing the soap and wetting agent dispenser

INSTRUCTIONAL MATERIALS

Textbooks:

a. Ruel and Nolte, Servicing Electrical Appliances, Vol. 2
b. Whirlpool, Dishwashers, Trash Mashers and Disposers

Student Manuals:

Georgia, Major Appliances: Secondary, Unit MA-22

Tools and Equipment:

a. VOM meter
b. Hand tools
c. Dispensers
d. Dishwasher
e. Wiring schematic
f. Shop manual

LAB HOURS	8
CLASS HOURS	2

EVALUATION (AR-32)

a. Given an automatic dishwasher and necessary tools and equipment, the student will test and replace the soap and wetting agent dispensers. Installation of parts must be within manufacturer's specifications and the machine must operate as intended by the manufacturer.

b. Review questions in Ruel and Nolte.

c. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

d. V'TECS, Appliance Repairer, Task No. 59.

TASK

AR-33 Testing and replacing the dishwasher drain pump

PERFORMANCE OBJECTIVE

Test, remove and replace or repair dishwasher drain pump.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Location and description of drain pump
b. Types of pumps
c. Testing the pump for proper operation
d. Removing and replacing pump

Provide Demonstration On:

Testing, removing and replacing pump

Provide Practical Application On:

Testing, removing and replacing drain pump

INSTRUCTIONAL MATERIALS

Textbooks:

a. Ruel and Nolte, Servicing Electrical Appliances, Vol. 2
b. Whirlpool, Dishwashers, Trash Mashers and Disposers

Student Manuals:

Georgia, Major Appliances: Secondary, Unit MA-23

Tools and Equipment:

a. VOM meter
b. Hand tools
c. Drain pumps
d. Dishwasher
e. Wiring schematic
f. Shop manual

LAB HOURS	8
CLASS HOURS	2

EVALUATION (AR-33)

a. Given an automatic dishwasher and necessary tools and equipment, the student will test and replace the drain pump. Installation of the parts must be within the manufacturer's specifications and the machine must operate as intended by the manufacturer.

b. Review questions in Ruel and Nolte.

c. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

AR-34 Testing and replacing the dishwasher motor and relay

PERFORMANCE OBJECTIVE

Test, remove and replace the motor and relay.

INSTRUCTIONAL ACTIVITIES

Prerequisite Tasks:

EL-03 through EL-07, EL-18, EL-19

Provide Information On:

a. Operation of relay
b. Purpose of relay
c. Interaction of timer and motor relay
d. Motor classification
e. Testing the motor

Provide Demonstration On:

Testing the motor relay and motor

Provide Practical Application On:

Testing, removing, and replacing the motor and relay

INSTRUCTIONAL MATERIALS

Textbooks:

a. Ruel and Nolte, Servicing Electrical Appliances, Vol. 2
b. Whirlpool, Dishwashers, Trash Mashers and Disposers

Student Manuals:

Georgia, Major Appliances: Secondary, Unit MA-21

Tools and Equipment:

a. VOM meter
b. Hand tools
c. Motor and relay
d. Dishwasher
e. Wiring schematic
f. Shop manual

LAB HOURS	8
CLASS HOURS	2

EVALUATION (AR-34)

a. Given an automatic dishwasher and necessary tools and equipment, the student will test and replace the motor and relay. Installation of the parts must be within the manufacturer's specifications and the machine must operate as intended by the manufacturer.

b. Review questions in Ruel and Nolte.

c. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

d. V'TECS, Appliance Repairer, Task No. 27.

TASK

AR-35 Testing and replacing the clothes washer timer and solenoids

PERFORMANCE OBJECTIVE

Test, remove and replace the timer and fill valve solenoid and clutch or brake solenoids.

INSTRUCTIONAL ACTIVITIES

Prerequisite Tasks:

EL-03 through EL-06

Provide Information On:

a. Operation and function of timer and solenoids
b. Timer motor
c. Timer contacts
d. Testing the timer
e. Location of solenoids
f. Testing solenoids
g. Timer and solenoid interaction

Provide Demonstration On:

a. Testing and replacing clutch
b. Testing and replacing brake solenoids

Provide Practical Application On:

Removing and replacing the timer, fill valve and clutch or brake solenoids

INSTRUCTIONAL MATERIALS

Textbooks:

a. Ruel and Nolte, *Servicing Electrical Appliances*, Vol. 2
b. Whirlpool, *Automatic Washers*

A/Vs:

Georgia, "Total Washing Machine Operation," slide/tape MA-10a, MA-10b; "Electrical Systems Operation and Troubleshooting," MA-11a, MA-11b

Student Manuals:

a. Georgia, *Major Appliances: Secondary*, Units MA-10, MA-11
b. Whirlpool, *Automatic Washers*

Tools and Equipment:

a. VOM meter
b. Hand tools
c. Washing machine

(Continued on back)

LAB HOURS 11

CLASS HOURS 4

EVALUATION (AR-35)

a. Given a clothes washing machine and necessary tools and equipment, the student will test, remove and replace the timer and fill solenoid, clutch solenoid and brake solenoid. All work must be within manufacturer's specifications and the machine must perform as the manufacturer intended with no indication of water leakage.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

c. Review questions in Ruel and Nolte.

d. V'TECS, Appliance Repairer, Task No. 45.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

d. Timers and solenoids
e. Wiring schematic
f. Shop manual

TASK

AR-36 Testing and replacing the clothes washer water level control and door switches

PERFORMANCE OBJECTIVE

Test, remove and replace the water level control and door switches.

INSTRUCTIONAL ACTIVITIES

Prerequisite Tasks:

EL-03 through EL-06

Provide Information On:

a. Operation and function of switches
b. Location of switches
c. Testing the switches
d. Interaction of timer, switches and fill valve

Provide Demonstration On:

a. Testing and replacing water level control
b. Testing and replacing door switches

Provide Practical Application On:

Testing, removing and replacing the water level control and door switches

INSTRUCTIONAL MATERIALS

Textbooks:

a. Ruel and Nolte, Servicing Electrical Appliances, Vol. 2
b. Whirlpool, Automatic Washers

A/Vs:

Georgia, "Electrical Systems Operation and Troubleshooting," slide/tape MA-11a, MA-11b

Student Manuals:

a. Georgia, Major Appliances: Secondary, Unit MA-11
b. Whirlpool, Automatic Washers

Tools and Equipment:

a. VOM meter
b. Hand tools
c. Washing machine
d. Various switches
e. Wiring schematic
f. Shop manual

LAB HOURS	8
CLASS HOURS	4

EVALUATION (AR-36)

a. Given a clothes washing machine and necessary tools and equipment, the student will test, remove and replace the water level control and door switches. All work must be within manufacturer's specifications and the machine must perform as the manufacturer intended with no indication of water leakage.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

c. Review questions in Ruel and Nolte.

d. V'TECS, Appliance Repairer, Task No. 19.

TASK

AR-37 Checking and replacing the clothes washer agitator

PERFORMANCE OBJECTIVE

Remove and replace the agitator.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Operation and function of agitator
b. Removing agitator and inspecting
c. Replacing agitator

Provide Demonstration On:

Checking agitator

Provide Practical Application On:

Checking, removing and replacing the agitator

INSTRUCTIONAL MATERIALS

Textbooks:

a. Ruel and Nolte, Servicing Electrical Appliances, Vol. 2
b. Whirlpool, Automatic Washers

Student Manuals:

Whirlpool, Automatic Washers

Tools and Equipment:

a. Washing machine
b. Agitators
c. Shop manual

LAB HOURS	2
CLASS HOURS	2

EVALUATION (AR-37)

a. Given a clothes washing machine and necessary tools and equipment, the student will check, remove and replace the agitator. All work must be within manufacturer's specifications and the machine must perform as the manufacturer intended with no indication of water leakage.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

c. Review questions in Ruel and Nolte.

TASK

AR-38 Testing and repairing the clothes washer drain pump

PERFORMANCE OBJECTIVE

Test, remove and replace the drain pump.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Operation and function of pump
b. Types of pumps
c. Pump seals
d. Testing the pump for proper operation

Provide Demonstration On:

Repairing pump

Provide Practical Application On:

Testing, removing and repairing the pump

INSTRUCTIONAL MATERIALS

Textbooks:

a. Ruel and Nolte, Servicing Electrical Appliances, Vol. 2
b. Whirlpool, Automatic Washers

A/Vs:

Gerogia, "Water Systems Operation and Troubleshooting," slide/tape MA-15a, MA-15b

Student Manuals:

a. Georgia, Major Appliances: Secondary, Unit MA-15
b. Whirlpool, Automatic Washers

Tools and Equipment:

a. VOM meter
b. Hand tools
c. Washing machine
d. Drain pumps
e. Shop manual

LAB HOURS	11
CLASS HOURS	4

EVALUATION (AR-38)

a. Given a clothes washing machine and the necessary tools and equipment, the student will test, remove and replace the drain pump. All work must be within manufacturer's specifications and the machine must perform as the manufacturer intended with no indication of water leakage.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

c. Review questions in Ruel and Nolte.

TASK

AR-39 Testing and replacing the clothes washer clutch and transmission

PERFORMANCE OBJECTIVE

Test, remove and replace the clutch and transmission.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Operation and function of clutch and transmission
b. Types and styles
c. Removing and replacing
d. Inspection

Provide Demonstration On:

a. Testing and replacing clutch
b. Testing and replacing transmission

Provide Practical Application On:

Testing, removing and replacing the clutch and transmission

INSTRUCTIONAL MATERIALS

Textbooks:

a. Ruel and Nolte, Servicing Electrical Appliances, Vol. 2
b. Whirlpool, Automatic Washers

A/Vs:

Georgia, "Mechanical Systems Operation and Troubleshooting," slide/tape MA-13a, MA-13b

Student Manuals:

a. Georgia, Major Appliances: Secondary, Unit MA-13
b. Whirlpool, Automatic Washers

Tools and Equipment:

a. Special tools required by manufacturer
b. Hand tools
c. Washing machine
d. Clutches and transmissions
e. Shop manual

LAB HOURS	12
CLASS HOURS	4

EVALUATION (AR-39)

a. Given a clothes washing machine and necessary tools and equipment, the student will test, remove and repair the clutch and transmission. All work must perform as the manufacturer intended with no indication of water leakage.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

c. Review questions in Ruel and Nolte.

TASK

AR-40 Servicing and replacing the clothes washer motor and relay

PERFORMANCE OBJECTIVE

Test, remove and replace the motor and relay.

INSTRUCTIONAL ACTIVITIES

Prerequisite Tasks:

EL-03 through EL-06, EL-18

Provide Information On:

a. Operation and function of relay
b. Purpose of relay
c. Interaction of timer and motor realy
d. Motor classification
e. Testing the motor

Provide Demonstration On:

Testing and replacing the motor and relay

Provide Practical Application On:

Testing, removing and replacing the motor and relay

INSTRUCTIONAL MATERIALS

Textbooks:

a. Whirlpool, Automatic Washers
b. Ruel and Nolte, Servicing Electrical Appliances, Vol. 2

A/Vs:

Georgia, "Electrical Systems Operation and Troubleshooting," slide/tape MA-11a, MA-11b

Student Manuals:

a. Georgia, Major Appliances: Secondary, Unit MA-11
b. Whirlpool, Automatic Washers

Tools and Equipment:

a. VOM meter
b. Hand tools
c. Washing machine
d. Motors and relays
e. Wiring schematic
f. Shop manual

LAB HOURS	12
CLASS HOURS	4

EVALUATION (AR-40)

a. Given a clothes washing machine and necessary tools and equipment, the student will test, remove and replace the motor and relay. All work must be within manufacturer's specifications and machine must perform as the manufacturer intended with no indication of water leakage.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

c. Review questions in Ruel and Nolte.

d. V'TECS, Appliance Repairer, Task Nos. 27, 90.

TASK

AR-41 Heating and cooking with petroleum gases

PERFORMANCE OBJECTIVE

Relate the characteristics of petroleum gases and describe safe working procedures.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Natural gas definition and origin
b. Composition
c. Characteristics
d. Comparison to other fuels
e. Temperatures
f. Combustion ratio
g. Caloric value
h. Operating pressures
i. Boiling point
j. Flammability
k. Safety while working with petroleum gases
l. Liquified petroleum gas (LPG)
m. Storage and transportation
n. National Fuel Gas Code (NFGC)

Provide Demonstration On:

a. Safety procedures
b. Handling LPG cylinders

Provide Practical Application On:

a. Identifying petroleum gases by characteristics
b. Refilling LPG cylinder

INSTRUCTIONAL MATERIALS

Textbooks:

a. National Training Aids, Gas Water Heating, Cooking and Heating
b. Althouse, Modern Refrigeration

A/Vs:

Georgia, "Applying Gas Fuel Combustion and Safety Principles," slide/tape HE-04a

Student Manuals:

Georgia, Heating: Post Secondary, Unit HE-04

Tools and Equipment:

a. Natural gas source (Bunson burner)
b. LPG cylinders
c. "Characteristic" charts

LAB HOURS	2
CLASS HOURS	8

EVALUATION (AR-41)

a. Given a list of characteristics and different petroleum gases, the student will match the characteristic to the gas. One hundred percent accuracy is required.

b. Given an empty LPG cylinder, the student will fill the cylinder with gas. Specified weight must be maintained and all safety precautions must be exercised.

c. Given necessary materials and information, the student will develop a safety checklist for a gas appliance repair shop. The checklist must include all given safety factors.

d. Georgia, Heating and Air Conditioning, Instructor Guide, Vol. IV, 1980.

TASK

AR-42 Inspecting heat exchangers

PERFORMANCE OBJECTIVE

Inspect and determine heat rise for heat exchangers.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Convection (natural and forced)
b. Radiation
c. Flue restrictors
d. Design and material
e. Purpose of heat exchanger
f. Inspection
g. Rated temperature rise

Provide Demonstration On:

a. Inspection techniques
b. Checking heat rise

Provide Practical Application On:

a. Inspecting heat exchanger
b. Checking heat rise

INSTRUCTIONAL MATERIALS

Textbooks:

National Training Aids, Heating Service Training Manual

A/Vs:

Georgia, "Inspecting and Determining Heat Rise of Heat Exchangers," HE-13a

Student Manuals:

a. Georgia, Heating: Post Secondary, Unit HE-13
b. National Training Aids, Gas Heating, Student Workbook

Tools and Equipment:

a. Inspection tools
b. Heat exchangers
c. Thermometers

LAB HOURS	8
CLASS HOURS	4

EVALUATION (AR-42)

a. Given a gas space heater with faulty heat exchanger and excessive heat rise, the student will inspect the exchanger and determine heat rise. All defects must be located and heat rise calculations must be within 10% of instructor's. Student must determine extent that heat rise exceeds specifications.

b. Georgia, Heating and Air Conditioning, Instructor Guide, Vol. IV, 1980.

TASK

AR-43 Replacing gas orifices

PERFORMANCE OBJECTIVE

Install a gas orifice.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. National Fuel Gas Code
b. Purpose of orifice
c. Safety precautions
d. Typical installation
e. Operating procedures
f. Different sizes used for different gasses
g. Tool list

Provide Demonstration On:

a. Typical installation
b. Operating procedures
c. Interpreting NFGC

Provide Practical Application On:

Calculating size and installing an orifice

INSTRUCTIONAL MATERIALS

Textbooks:

National Training Aids, Gas Water Heating, Cooking and Heating

Tools and Equipment:

a. Tools necessary for task
b. Manufacturer's manual
c. NFGC manual

LAB HOURS	8
CLASS HOURS	4

EVALUATION (AR-43)

a. Given an operable gas appliance, an assortment of orifices and necessary tools and equipment, the student will select the proper orifice and install according to manufacturer's specifications.

b. V'TECS, Appliance Repairer, Task Nos. 70, 77.

TASK

AR-44 Adjusting pilot lights

PERFORMANCE OBJECTIVE

Adjust pilot light to given specifications.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Pilot light description
b. Primary and secondary air
c. Burner tip
d. Safety devices
e. Automatic ignition devices
f. Flame sensors
g. Thermocouples
h. Bi-metal switches

Provide Demonstration On:

a. Lighting the pilot
b. Adjusting gas pressure and air
c. Checking safety devices

Provide Practical Application On:

a. Lighting and adjusting the pilot light
b. Observing functioning safety devices

INSTRUCTIONAL MATERIALS

Textbooks:

National Training Aids, Gas Water Heating, Cooking and Heating

A/Vs:

Georgia, "Installing and Servicing Pilot Ignition Devices," slide/tape HE-10a, HE-10b

Student Manuals:

Georgia, Heating: Post Secondary, Unit HE-10

LAB HOURS	8
CLASS HOURS	4

EVALUATION (AR-44)

a. Given a gas space heater, the student will light and adjust the pilot light. Air/gas ratio and pressure must meet manufacturer's specifications.

b. Georgia, Heating and Air Conditioning, Instructor Guide, Vol. IV, 1980.

TASK

AR-45 Replacing and adjusting main gas burners

PERFORMANCE OBJECTIVE

Replace and adjust the gas burner to achieve proper combustion.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Purpose of adjusting gas burner
b. The National Fuel Gas Code
c. Safety precautions
d. Operating the system
e. Checking gas pressure
f. Adjusting the primary air
g. Checking the bonnet temperature controls
h. Tool list

Provide Demonstration On:

a. Adjusting gas burner properly
b. Operating the system
c. Checking gas pressures
d. Interpreting the NFGC

Provide Practical Application On:

a. Adjusting all gas burners on a range and oven
b. Adjusting gas burner on a water heater
c. Adjusting gas burner on a clothes dryer

INSTRUCTIONAL MATERIALS

Textbooks:

National Training Aids, Gas Water Heating, Cooking and Heating

A/Vs:

Georgia, "Servicing Burners," slide/tape HE-12a

Student Manuals:

a. Georgia, Heating: Post Secondary, Unit HE-12
b. National Training Aids, Fundamentals of Gas Control Systems, Student Workbook

Tools and Equipment:

a. National Fuel Gas Code
b. Draft guage
c. Stack thermometer

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LAB HOURS	8
CLASS HOURS	4

EVALUATION (AR-45)

a. Given the necessary tools and equipment, the student will replace and adjust the gas burners on a gas range, oven, hot water heater and dryer. The flame must be sharp blue, rest on burner port and not make a blowing noise.

b. Georgia, Heating and Air Conditioning, Instructor Guide, Vol. IV, 1980.

c. V'TECS, Appliance Repairer, Task Nos. 51, 54, 95.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

d. Carbon dioxide analyzer
e. Oxygen analyzer

TASK

AR-46 Replacing and adjusting gas regulators

PERFORMANCE OBJECTIVE

Install and adjust an appliance gas pressure regulator.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Components of the regulator
b. Inspecting the diaphragm
c. Selecting regulators for a system
d. High and low pressure gas
e. Double regulation
f. Adjustment procedures
g. Venting the regulator
h. Using a manometer

Provide Demonstration On:

a. Inspecting components
b. Adjusting the regulator

Provide Practical Application On:

a. Disassembling and reassembling regulator
b. Adjusting regulator

INSTRUCTIONAL MATERIALS

Textbooks:

National Training Aids, Gas Water Heating, Cooking and Heating

A/Vs:

Georgia, "Adjusting Regulators," slide/tape HE-08a

Student Manuals:

a. Georgia, Heating: Post Secondary, Unit HE-08
b. National Training Aids, Fundamentals of Gas Control Systems, Student Workbook

Tools and Equipment:

a. Various regulators
b. Hand tools
c. Manometer

LAB HOURS	8
CLASS HOURS	4

EVALUATION (AR-46)

a. Given a gas appliance and necessary tools and equipment, the student will replace and adjust the regulator. All work must conform to NFGC and pressure must be within manufacturer's specifications.

b. Georgia, Heating and Air Conditioning, Instructor Guide, Vol. IV, 1980.

c. V'TECS, Appliance Repairer, Task No. 64.

TASK

AR-47 Testing, replacing and adjusting combination diaphragm valves

PERFORMANCE OBJECTIVE

Install and service a combination gas valve.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Identifying a combination valve
b. Purpose of combination valve
c. The four components combined in one valve
    1. Manual control
    2. Pilot supply, adjustment and safety
    3. Pressure regulator
    4. On-off solenoid

Provide Demonstration On:

Adjusting the valve

Provide Practical Application On:

Testing, replacing and adjusting the valve

INSTRUCTIONAL MATERIALS

Textbooks:

National Training Aids, Gas Water Heating, Cooking and Heating

A/Vs:

Georgia, "Installing and Servicing Combination Gas Valves," slide/tape HE-11a, HE-11b

Student Manuals:

a. Georgia, Heating: Post Secondary, Unit HE-11
b. National Training Aids, Fundamentals of Gas Control Systems, Student Workbook

Tools and Equipment:

a. NFGC
b. Various combination valves
c. Manometer
d. Tools

LAB HOURS	8
CLASS HOURS	4

EVALUATION (AR-47)

a. Given a gas appliance utilizing a combination gas valve and necessary tools and equipment, the student will replace the valve and make all necessary adjustments. All work must conform to NFGC and adjustments must be within manufacturer's specifications.

b. Georgia, Heating and Air Conditioning, Instructor Guide, Vol. IV, 1980.

TASK

AR-48 Testing and replacing electromagnetic safety devices

PERFORMANCE OBJECTIVE

Diagnose and service the electromagnetic safety controls.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Purpose of safety devices
b. Thermocouples
c. Thermopiles
d. Electromagnetic power unit
e. Diagnosing problems
f. Energy cutoff switches

Provide Demonstration On:

Testing devices

Provide Practical Application On:

Diagnosing problems and changing unit

INSTRUCTIONAL MATERIALS

Textbooks:

National Training Aids, Gas Water Heating, Cooking and Heating

A/Vs:

Georgia, "Installing and Servicing Pilot Ignition Devices," slide/tape HE-10a, HE-10b

Student Manuals:

a. Georgia, Heating: Post Secondary, Unit HE-10
b. National Training Aids, Fundamentals of Gas Control Systems, Student Workbook

Tools and Equipment:

a. Safety devices
b. Test meter
c. Hand tools
d. Test equipment

LAB HOURS	8
CLASS HOURS	4

EVALUATION (AR-48)

a. Given a gas appliance with a defective electromagnetic safety device and necessary tools and equipment, the student will diagnose the problem and install the device. Problems must be located and all work must conform to NFGC and manufacturer's specifications.

b. Georgia, Heating and Air Conditioning, Instructor Guide, Vol. IV, 1980.

c. V'TECS, Appliance Repairer, Task Nos. 12, 17, 25.

TASK

AR-49 Testing, replacing and adjusting gas oven controls

PERFORMANCE OBJECTIVE

Test and repair gas oven controls.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Thermostat control
b. Direct and indirect controlled ovens
c. Hydraulic diastat control
d. Electric thermostat control
e. Multiple pilot burners
f. Temperature ranges of controls
g. Safety devices
h. Oven control checks
i. Thermostat checks
j. Flame switch checks

Provide Demonstration On:

Testing and replacement steps of thermostat and oven temperature control

Provide Practical Application On:

Test and replace a direct and an indirect oven temperature control system

INSTRUCTIONAL MATERIALS

Textbooks:

a. National Training Aids, Cooking Service Training Manual
b. Whirlpool, Range Service

Student Manuals:

a. Whirlpool, Range Service, Gas
b. National Training Aids, Fundamentals of Gas Controls Systems, Student Workbook

Tools and Equipment:

a. Hand tools
b. Manufacturer's manual
c. Pyrometer
d. Multimeter

LAB HOURS 8

CLASS HOURS 4

EVALUATION (AR-49)

a. Given a gas oven with defective temperature controls and necessary tools and equipment, the student will determine the type of replacement control. The replacement control must be 100% accurate. The problem must be identified and all work must conform to NFGC and manufacturer's specifications.

b. V'TECS, Appliance Repairer, Task No. 12.

TASK

AR-50 Testing, replacing and adjusting gas range controls

PERFORMANCE OBJECTIVE

Test and repair gas range surface burner controls.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Manifold assembly
b. Surface burners
c. Surface burner controls
d. Surface burner pilot
e. Safety devices
f. Cleaning and checking burners
g. Adjusting flame

Provide Demonstration On:

Adjusting surface burners and pilots

INSTRUCTIONAL MATERIALS

Textbooks:

a. National Training Aids, Cooking Service Training Manual
b. Whirlpool, Range Service

Student Manuals:

a. Whirlpool, Range Service, Gas
b. National Training Aids, Fundamentals of Gas Control Systems, Student Workbook

Tools and Equipment:

a. Hand tools
b. Various controls
c. NFGC

LAB HOURS 8

CLASS HOURS 4

EVALUATION (AR-50)

Given a gas range with surface burners improperly adjusted and malfunctioning controls, the student will repair the control and adjust the burner. All work must be in accordance with the NFGC and adjustments must be in accordance with the manufacturer's specifications.

TASK

AR-51 Testing, replacing and adjusting gas/electric controls

PERFORMANCE OBJECTIVE

Test and replace gas/electric controls.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Millivolt controls
b. 115 VAC controls
c. Direct and indirect controlling systems
d. Thermopile assembly
e. Constant pilot
f. Oven control solenoid
g. Thermostat diastat
h. Flame switch
i. Testing procedures

Provide Demonstration On:

Testing controls and adjusting temperature range and flame

INSTRUCTIONAL MATERIALS

Textbooks:

a. National Training Aids, Cooking Service Training Manual
b. Whirlpool, Range Service

Student Manuals:

a. Whirlpool, Range Service, Gas
b. National Training Aids, Fundamentals of Gas Control Systems, Student Workbook

Tools and Equipment:

a. Various gas/electric controls
b. Pyrometer
c. Thermopile adapter
d. VOM meter

LAB HOURS 8

CLASS HOURS 4

EVALUATION (AR-51)

Given a gas range with defective gas/electric controls, necessary tools and equipment, the student will locate and correct problems. Identification of problem must be 100% accurate and all work must conform to NFGC and manufacturer's specifications.

TASK

AR-52 Testing and replacing gas water heater relief valves

PERFORMANCE OBJECTIVE

Test and replace gas water heater relief valves.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Water vapor pressure
b. Purpose of relief valves
    1. Pressure relief valves
    2. Temperature relief valves
    3. Combination relief valves
c. Valve components
d. Location of valve
e. Testing the valve
f. Possible malfunctions

Provide Demonstration On:

Testing and replacing all three types of relief valves

Provide Application On:

a. Testing relief valves
b. Replacing relief valves

INSTRUCTIONAL MATERIALS

Textbooks:

National Training Aids, Water Heating Service Training Manual

Student Manuals:

National Training Aids, Gas Water Heating Systems, Student Workbook

Tools and Equipment:

a. Various relief valves
b. Hand tools

LAB HOURS	8
CLASS HOURS	4

EVALUATION (AR-52)

a. Given a gas hot water heater with a defective relief valve, necessary tools and equipment, the student will evaluate the condition and replace the valve. The work must conform to NFGC.

b. V'TECS, Appliance Repairer, Task No. 57.

TASK

AR-53 Testing and replacing gas water heater thermostats

PERFORMANCE OBJECTIVE

Test and replace the gas water heater thermostat.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Rod and tube assembly
b. Clicker mechanism
c. Testing procedures
d. Adjustment of thermostat

Provide Demonstration On:

Testing and replacing thermostat

Provide Practical Application On:

Testing and replacing thermostat

INSTRUCTIONAL MATERIALS

Textbooks:

National Training Aids, Water Heating Service Training Manual

Student Manuals:

National Training Aids, Gas Water Heating Systems, Student Workbook

LAB HOURS 8

CLASS HOURS 4

EVALUATION (AR-53)

a. Given a gas water heater with a faulty thermostat and necessary tools and equipment, the student will determine serviceability and remove and replace the thermostat. Serviceability decisions must be 100% accurate and all work must conform to NFGC and manufacturer's specifications.

b. V'TECS, Appliance Repairer, Task No. 20.

TASK

AR-54 Testing, replacing and adjusting water heater gas controls

PERFORMANCE OBJECTIVE

Test and replace water heater gas controls.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Electromagnetic safety system
b. Energy cutoff device
c. Gas pressure regulator
d. Regulator adjustment
e. Relighting the pilot
f. Automatic pilot

Provide Demonstration On:

a. Testing safety devices
b. Adjusting regulator
c. Replacing controls

Provide Practical Application On:

a. Testing and adjusting all controls
b. Removing and replacing controls

INSTRUCTIONAL MATERIALS

Textbooks:

National Training Aids, Water Heating Service Training Manual

Student Manuals:

National Training Aids, Gas Water Heating Systems, Student Workbook

Tools and Equipment:

a. Water heater controls
b. Test equipment
c. Hand tools

LAB HOURS	8
CLASS HOURS	4

EVALUATION (AR-54)

a. Given a gas water heater with faulty gas controls and necessary tools and equipment, the student will locate and correct the problem. Upon completion the water must be heated and automatically maintained at a specified temperature.

b. V'TECS, Appliance Repairer, Task Nos. 12, 07, 08.

TASK

AR-55 Servicing gas clothes dryer mechanical/electrical systems

PERFORMANCE OBJECTIVE

Identify components and troubleshoot the mechanical system of a gas clothes dryer.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Component identification
b. Visual inspection
c. Belt function and inspection
d. Drum inspection
e. Air leaks
f. Electrical components
g. Drive motor
h. Timer
i. Automatic pilot (electric)

Provide Demonstration On:

a. Replacing belt
b. Replacing drum
c. Adjusting door
d. Replacing motor

Provide Practical Application On:

a. Inspecting and replacing belt and drum
b. Adjusting door
c. Replacing motor and timer

INSTRUCTIONAL MATERIALS

Textbooks:

Whirlpool, Automatic Dryers

Student Manuals:

Whirlpool, Automatic Dryers, Gas

Tools and Equipment:

a. Gas dryer
b. Components
c. Shop manual

LAB HOURS	8
CLASS HOURS	4

EVALUATION (AR-55)

a. Given a gas clothes dryer with known malfunctions in the mechanical and electrical systems and necessary tools and equipment, the student will locate all problems and repair it as needed. Troubleshooting techniques must be systematic and effective. Repairs must be according to manufacturer's specifications.

b. V'TECS, Appliance Repairer, Task No. 16.

TASK

AR-56 Testing, replacing and adjusting dryer gas controls

PERFORMANCE OBJECTIVE

Test and replace dryer gas controls.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Electromagnetic safety system
b. Gas pressure regulator
c. Regulator adjustment
d. Relighting the pilot
e. Main dryer valve
f. Main burner solenoid
g. Automatic ignition
h. High limit, cycling and auxillary thermostat
i. Thermocouple

Provide Demonstration On:

a. Testing safety devices
b. Adjusting regulator
c. Replacing controls

Provide Practical Application On:

a. Testing and adjusting all controls
b. Removing and replacing controls

INSTRUCTIONAL MATERIALS

Textbooks:

Whirlpool, Automatic Dryers

Student Manuals:

a. Whirlpool, Automatic Dryers, Gas
b. National Training Aids, Fundamentals of Gas Control Systems, Student Workbook

Tools and Equipment:

a. Gas dryer
b. Components
c. Hand tools
d. Test equipment

LAB HOURS	8
CLASS HOURS	4

EVALUATION (AR-56)

a. Given a gas clothes dryer with faulty gas controls and necessary tools and equipment, the student will locate and correct the problem. Upon completion, the dryer must maintain temperatures within specifications and all safety devices must work as designed.

b. V'TECS, Appliance Repairer, Task No. 17.

TASK

AR-57 Testing, replacing and adjusting gas space heater thermostats

PERFORMANCE OBJECTIVE

Test and replace space heater thermostats.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Gas space heaters
b. Wall thermostats (mercury and contact)
c. Spiral, disc and coil bimetals
d. Heat anticipators
e. Wiring circuit

Provide Demonstration On:

Testing and replacing thermostat

Provide Practical Application On:

Testing and replacing wall thermostat

INSTRUCTIONAL MATERIALS

Textbooks:

National Training Aids, Heating Service Training Manual

A/Vs:

Georgia, "Servicing Electrical Controls," slide/tape HE-15a

Student Manuals:

a. National Training Aids, Gas Heating Controls Systems, Student Workbook
b. Georgia, Heating: Post Secondary, Unit HE-15

Tools and Equipment:

a. Various thermostats
b. Test equipment
c. Space heater

LAB HOURS 8

CLASS HOURS 4

EVALUATION (AR-57)

a. Given a gas heater with a defective wall thermostat and necessary tools and equipment, the student will locate the problem and restore it to proper operation. The heater must cycle on and off within a given temperature range.

b. Georgia, Heating and Air Conditioning, Instructor Guide, Vol. IV, 1980.

c. V'TECS, Appliance Repairer, Task No. 11.

TASK

AR-58 Testing, replacing and adjusting space heater fan and controls

PERFORMANCE OBJECTIVE

Test, replace and adjust fan limit and controls.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Limit and fan controls
b. Components
c. Temperature setting
d. Heat sensitive fan controls
e. Fan delay
f. Testing procedures
g. Fan motors
h. Fan blowers

Provide Demonstration On:

Testing fan motor and limit controls

Provide Practical Application On:

a. Test and replace fan limits and controls
b. Test and replace motor and blower system

INSTRUCTIONAL MATERIALS

Textbooks:

National Training Aids, Heating Service Training Manual

A/Vs:

Georgia, "Servicing Electrical Controls," slide/tape HE-15a

Student Manuals:

a. National Training Aids, Gas Heating Controls Systems, Student Workbook
b. Georgia, Heating: Post Secondary, Unit HE-15

Tools and Equipment:

a. Heater with blower unit
b. Various controls
c. Hand tools
d. Test equipment

LAB HOURS 8

CLASS HOURS 4

EVALUATION (AR-58)

a. Given a gas heater with a defective fan and/or controls and necessary tools and equipment, the student will locate the problem and return the unit to service. All work must conform to the manufacturer's specifications and the fan must operate within given limits.

b. Georgia, Heating and Air Conditioning, Instructor Guide, Vol. IV, 1980.

c. V'TECS, Appliance Repairer, Task No. 82.

TASK

AR-59 Testing, replacing and adjusting space heater gas controls

PERFORMANCE OBJECTIVE

Test and replace heater gas controls.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Convection heating
b. Thermostat and non-thermostat controlled
c. Review of combination valve
d. Non-electrical controls
e. Testing procedures
f. Millivolt controls
g. Pressure regulator

Provide Demonstration On:

Testing controls

Provide Practical Application On:

Testing and replacing controls

INSTRUCTIONAL MATERIALS

Textbooks:

National Training Aids, Heating Service Training Manual

Student Manuals:

National Training Aids, Gas Heating Controls Systems, Student Workbook

Tools and Equipment:

a. Space heater
b. Test equipment
c. Hand tools

LAB HOURS	8
CLASS HOURS	4

EVALUATION (AR-59)

a. Given a gas heater with malfunctioning gas controls and necessary tools and equipment, the student will locate the problem and repair it as needed. Al repairs must conform to the NFGC and heater controls must operate within manufacturer's specifications.

b. V'TECS, Appliance Repairer, Task No. 63.

TASK

AR-60 Testing, replacing and adjusting outdoor grill gas controls

PERFORMANCE OBJECTIVE

Test and replace outdoor grill gas controls.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Non-electrical controls
b. Testing procedures
c. Millivolt controls
d. Pressure regulator
e. LP conversions
f. Grill care

Provide Demonstration On:

Testing controls

Provide Practical Application On:

Testing and replacing controls

INSTRUCTIONAL MATERIALS

Student Manual:

National Training Aids, Fundamentals of Gas Control Systems, Student Workbook

Tools and Equipment:

a. Outdoor grill
b. Test Equipment
c. Hand tools

LAB HOURS	4
CLASS HOURS	4

EVALUATION (AR-60)

a. Given an outdoor gas grill with malfunctioning gas controls and necessary tools and equipment, the student will locate the problem and repair it as needed. All repairs must conform to the NFGC and controls must operate within manufacturer's specifications.

b. V'TECS, Appliance Repairer, Task No. 63.

TASK

RF-01 Demonstrating a knowledge of the basic refrigeration concepts

PERFORMANCE OBJECTIVE

Demonstrate an understanding of the basic concepts of refrigeration.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Heat, energy and cold
b. Refrigeration effect
c. Three types of heat
d. Heat measurement
e. F. and C. conversions
f. B.T.U.
g. Three ways to heat transfer
h. Ambiant temperature
i. Gauge pressures
j. Boiling point
k. Thermostat
l. Compression
m. Melting point
n. Liquification
o. Vaporization
p. Condensation

Provide Demonstration On:

a. Methods of heat transfer
b. Centigrade and fahrenheit conversions
c. Measuring temperatures

INSTRUCTIONAL MATERIALS

Textbooks:

a. Prentice-Hall, Refrigeration and Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning

A/Vs:

Georgia, "Understanding Basic Refrigeration Concepts," slide/tape REF-03

Student Manuals:

a. Georgia, Refrigeration, Unit REF-03
b. Copeland Manuals

LAB HOURS	0
CLASS HOURS	4

EVALUATION (RF-01)

a. Given a list of the basic terms and principles used in refrigeration, the student will correctly match the terms and principles with their definitions. One hundred percent accuracy is required.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

RF-02 Describing the function of the basic refrigeration cycle components

PERFORMANCE OBJECTIVE

Identify and describe the components and their function in the basic refrigeration cycle.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Compressor, condenser, metering device and evaporator
b. Various pressures and temperatures during the refrigeration cycle
c. Transfer and types of heat
d. Theory of condensation
e. Sub-cooling
f. Freons
g. Conditions of refrigerant during the refrigeration cycle

Provide Demonstration On:

a. Major and minor components of the refrigeration cycle
b. Conditions of the refrigerant during the refrigeration cycle

Provide Practical Application On:

Identifying components and their functions on a refrigeration trainer

INSTRUCTIONAL MATERIALS

Textbooks:

a. Prentice-Hall, Refrigeration and Air Conditioning
b. Delmar, Principles of Refrigeration

A/Vs:

Georgia, "Understanding the Basic Refrigeration Cycle," slide/tape REF-04a, REF-04b, REF-04c

Student Manuals:

a. Georgia, Refrigeration, Unit REF-04
b. Copeland Manuals

Tools and Equipment:

a. Refrigeration trainer
b. Components

LAB HOURS	2
CLASS HOURS	2

EVALUATION (RF-02)

a. Given a refrigeration trainer, diagrams of the refrigeration system, and an actual refrigeration unit, the student will identify the purpose and function of each component in the system, explain the heat transfer process and describe the condition of the refrigerant during each stage of the refrigeration cycle with 100% accuracy.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

RF-03 Using refrigeration tools

PERFORMANCE OBJECTIVE

Demonstrate the proper handling and use of tools used in refrigeration.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Electric drill
b. Bench grinder
c. Refrigeration hand tools
d. Detecting faults and safety features on various hand tools
e. Thermometers
f. Pressure gauges
g. Tubing cutter and crimpers

Provide Demonstration On:

The use of various tools used in refrigeration

Provide Practical Application On:

a. Using drill, bench grinder, hand tools, thermometers, tubing cutter and crimper
b. Hooking up pressure gauges

INSTRUCTIONAL MATERIALS

Textbooks:

a. Prentice-Hall, *Refrigeration and Air Conditioning*
b. Delmar, *Principles of Refrigeration*

A/Vs:

Georgia, "Identifying Tools," slide/tape REF-05

Student Manuals:

Georgia, *Refrigeration*, Unit REF-05

Tools and Equipment:

a. Hand tools
b. Electric grinder
c. Electric drill
d. Refrigeration trainer
e. Tubing cutter and crimper

LAB HOURS 4

CLASS HOURS 2

EVALUATION (RF-03)

a. Given a set of various tools used in refrigeration and a refrigeration trainer, the student will demonstrate the application for a tool and a given job. The correct tool must be selected for each job and use must conform to standard shop practices.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

RF-04 Drilling, tapping and threading

PERFORMANCE OBJECTIVE

Drill correct size hole and tap internal threads and prepare external threads for pipe and standard bolt sizes.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Tapping and threading
b. Types of bolts and pipe
c. Washers and nuts
d. SAE, USS and metric threads
e. Types of screwdrivers
f. Threads per inch on galvanized and black pipe
g. Self-tapping screws
h. Sizing bits for tapping threads
i. Pipe fitting
j. Other fasteners

Provide Demonstration On:

Tapping and threading

Provide Practical Application On:

a. Drilling holes to accept taps
b. Tapping and threading (internal and external)
c. Tapping and threading galvanized black pipe

INSTRUCTIONAL MATERIALS

Textbooks:

a. Prentice-Hall, Refrigeration and Air Conditioning
b. Delmar, Principles of Refrigeration

A/Vs:

Georgia, "Tapping, Threading and Replacing Threads," slide/tape REF-06

Student Manuals:

Georgia, Refrigeration, Unit REF-06

Tools and Equipment:

a. Hand tools
b. Tap and die sets
c. Vice
d. Assorted screws and bolts
e. Assorted fittings
f. Galvanized and black pipe
g. Metal stock

LAB HOURS 10
CLASS HOURS 2

EVALUATION (RE-04)

a. Given necessary tools and equipment, the student will drill and tap a ¼", ½" and 3/8" hole to USS thread size, thread three two-inch studs to fit the tapped holes, and cut SAE threads on the opposite end allowing ¼" shoulder between threads. All work must conform to industry standards.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

RF-05 Identifying tubing and pipe fittings

PERFORMANCE OBJECTIVE

Identify the different types of pipe and tube fittings used in refrigeration systems.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Flare fittings
b. Sweat fittings
c. Quick couplings
d. Compression fittings
e. Types of tubing
f. Types of pipe

Provide Demonstration On:

The use of various types of fittings and pipe materials

Provide Practical Application On:

Selecting various types of fittings and pipe materials for specific jobs

INSTRUCTIONAL MATERIALS

Textbooks:

a. Prentice-Hall, Refrigeration and Air Conditioning
b. Delmar, Principles of Refrigeration

Student Manuals:

Georgia, Refrigeration, Unit REF-07

Tools and Equipment:

a. Flare fittings
b. Sweat fittings
c. Compression fittings
d. Tubing (copper)
e. Pipe (vc)

LAB HOURS	6
CLASS HOURS	2

EVALUATION (RF-05)

a. Given a list of terms and materials used in fitting operations and a selection of appropriate fittings, the student will match each fitting to a specific application with 100% accuracy.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

RF-06 Performing basic copper tubing operations

PERFORMANCE OBJECTIVE

Cut, flare, swage and bend soft and hard copper tubing.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Selecting proper tools for flaring, swaging, cutting and bending copper tubing
b. Proper method of preparing copper tubing for joining together
c. Selecting proper tools for flaring copper tubing

Provide Demonstration On:

a. Cutting, swaging and bending copper tubing
b. Flaring copper tubing
c. Fitting copper tubing of equal and unequal size together

Provide Practical Application On:

a. Cutting tubing
b. Flaring copper tubing
c. Bending copper tubing
d. Swaging copper tubing
e. Joining two pieces of copper tubing

INSTRUCTIONAL MATERIALS

Textbooks:

a. Prentice Hall, Refrigeration and Air Conditioning
b. Delmar, Principles of Refrigeration

A/Vs:

Georgia, "Basic Copper Tubing Operations," slides/tapes REF-08a, REF-08b

Student Manuals:

Georgia, Refrigeration, Unit REF-08

Tools and Equipment:

a. Swaging tools
b. Flaring tools
c. Bending tools
d. Tubing cutters
e. Copper tubing

LAB HOURS	8
CLASS HOURS	2

EVALUATION (RF-06)

a. Given soft and hard copper tubing and materials and equipment, the student will make flared fittings, swaged joints, join two pieces of unequal I.D. and will bend with proper accuracy a 90° angle. All work must conform to industry standards.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

RF-07 Soft soldering copper tubing

PERFORMANCE OBJECTIVE

Swage, clean, flux and soft solder copper tubing.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Safety
b. Joining copper tubing
c. Applying flux
d. Applying solder
e. Cleaning joints before soldering
f. Different types of solder
g. Capillary attraction
h. Procedures for brazing and soldering
i. Advantages of tin silver soldering
j. Setting up a solder torch

Provide Demonstration On:

a. Proper, flame while soldering
b. Applying solder correctly
c. Soldering air tight joints
d. Soldering uniform joints

Provide Practical Application On:

a. Joining copper tubing with various types of solder
b. Using different types of solder equipment

INSTRUCTIONAL MATERIALS

Textbooks:

a. Prentice-Hall, Refrigeration and Air Conditioning
b. Delmar, Principles of Refrigeration

A/Vs:

Georgia, "Soft Soldering Copper Tubing," slide/tape REF-09

Student Manuals:

Georgia, Refrigeration, Unit REF-09

Tools and Equipment:

a. Tools
b. Torch
c. Gloves
d. Pliers
e. 50-50, 95-5 and silver solder
f. Soldering paste and flux
g. Copper tubing

LAB HOURS	6
CLASS HOURS	2

EVALUATION (RF-07)

a. Given copper tubing and necessary tools and equipment, the student will prepare and solder two joints together. The joints must be airtight and uniform in appearance.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

RF-08 Silver brazing

PERFORMANCE OBJECTIVE

Silver braze refrigeration piping.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Definition of silver brazing
b. Oxyacetylene equipment
c. Type of flame
d. Torch angles for various jobs
e. Flow point of silver solder
f. Type and use of flux
g. Oil and oxygen mixture
h. Comparison chart and specification table for major competitive alloys
i. Brazing while tubing is under pressure
j. Ventilation
k. Safety
l. Preparing tubing to be brazed

Provide Demonstration On:

a. Soldering technique with silver solder
b. Applying solder and flux
c. Flame control
d. Proper joints being uniform and free of leaks

Provide Practical Application On:

a. Cutting, shaping and joining copper tubing
b. Silver brazing copper tubing

INSTRUCTIONAL MATERIALS

Textbooks:

a. Prentice-Hall, Refrigeration and Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Delmar, Principles of Refrigeration

A/Vs:

Georgia, "Silver Brazing," slide/tape REF-10

Student Manuals:

Georgia, Refrigeration, Unit REF-10

Tools and Equipment:

a. Oxy-acetylene torch
b. Silver solder
c. Flux
d. Lighter
e. Copper tubing
f. Tools

LAB HOURS	4
CLASS HOURS	2

EVALUATION (RF-08)

a. Given oxyacetylene equipment and proper materials, the student will prepare and silver braze four joints of copper tubing. Joints must be leakproof and conform to industry standards.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

RF-09 Handling refrigerants

PERFORMANCE OBJECTIVE

Demonstrate proper technique in handling, transforming, weighing and measuring refrigerants.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Refrigerant groups
b. Characteristics of each group
c. Safety precautions
d. Measuring refrigerants
e. Weighing refrigerants
f. Transferring refrigerants from one container to another

Provide Demonstration On:

The proper handling, transferring, weighing and measuring of each refrigerant group

Provide Practical Application On:

a. Checking the pressure on freon drums and recording the data
b. Determining type of freon from drum pressures
c. Transferring refrigerant from full to empty drums

INSTRUCTIONAL MATERIALS

Textbooks:

a. Prentice-Hall, Refrigeration and Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Delmar, Principles of Refrigeration

A/Vs:

Georgia, "Handling Refrigerants," slide/tape REF-11

Student Manuals:

a. Georgia, Refrigeration, Unit REF-11
b. Copeland Manual

Tools and Equipment:

a. Gauge set
b. Thermometer
c. Temperature and pressure chart
d. Empty and full cylinder

LAB HOURS	2
CLASS HOURS	2

EVALUATION (RF-09)

a. Given various refrigerants, containers and other equipment and materials, the student will safely transfer refrigerant from one container to another, check the pressure on tanks of gas and fill out data sheets properly.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

RF-10 Installing and using access valves

PERFORMANCE OBJECTIVE

Install and use various types of access (service) valves.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of access and service valves
b. Stem valves
c. Two way line valves
d. Tap on service valve
e. Schrader valves
f. Straddle valve
g. Piercing valves
h. Core type access valves
i. Line tap valves
j. Service valves or access valves
k. Applications for each type
l. Installing access valves
m. Cracking a valve

(Continued on back)

Provide Demonstration On:

a. The function of the "stem type" service valve while installing and removing gauge lines
b. Method of installing the access valve

Provide Practical Application On:

a. Gaining entrance to the refrigeration system through a "stem-type" service valve
b. Installing a soldered on Schrader type service valve

INSTRUCTIONAL MATERIALS

Textbooks:

a. Prentice-Hall, Refrigeration and Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Delmar, Principles of Refrigeration

A/Vs:

Georgia, "Using Access Valves," slide/tape REF-12

Student Manuals:

a. Georgia, Refrigeration, Unit REF-12
b. Copeland Manuals

Tools and Equipment:

a. Refrigeration systems
b. Access valves
c. Torch, solder and flux
d. Safety glasses
e. Gauge set
f. Leak detector

LAB HOURS	10
CLASS HOURS	5

EVALUATION (RF-10)

a. Given proper equipment and materials, the student will gain entrance to the refrigeration system through a stem type service valve and will install a Schrader type service valve. All work must be to industry standards.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

n. Process tube
o. Soldering the access service valve
p. Sight glass

TASK

RF-11 Maintaining refrigeration manifold gauges

PERFORMANCE OBJECTIVE

Calibrate a set of gauges at 0-PSIG and check against gas in a given tank by corresponding temperature to pressure.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. High pressure gauge
b. Compound gauge
c. Function of the gauge and manifold set
d. Zero PSIG setting
e. Reading the Pressure-Temperature Chart

Provide Demonstration On:

a. Reading gauges
b. Setting gauges at zero PSIG
c. Installing gauges

Provide Practical Application On:

a. Reading a series of gauges and recording data
b. Service valve inspection

INSTRUCTIONAL MATERIALS

Textbooks:

a. Prentice-Hall, Refrigeration and Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Delmar, Principles of Refrigeration

A/Vs:

Georgia, "Maintaining Refrigeration Manifold Changes," slide/tape REF-13

Student Manuals:

a. Georgia, Refrigeration, Unit REF-13
b. Copeland Manuals

Tools and Equipment:

a. Manifold and gauges
b. Freon
c. Safety glasses
d. Pressure and temperature chart

LAB HOURS	2
CLASS HOURS	2

EVALUATION (RF-11)

a. Given proper equipment and materials, the student will correctly calibrate and read a high pressure and a compound gauge. Readings must be within 5% of instructor's specifications.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

RF-12 Installing and using refrigeration manifold gauges

PERFORMANCE OBJECTIVE

Install and use refrigeration manifold gauges.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Use of manifold and gauge set
b. Installing manifold gauge
c. Purging
d. Positioning of service valve systems
e. Checking pressure drops
f. Safety hazards

Provide Demonstration On:

a. Installing and removing gauges and hoses
b. Reading gauges

Provide Practical Application On:

Installing and removing gauges on a refrigeration system

INSTRUCTIONAL MATERIALS

Textbooks:

a. Prentice-Hall, *Refrigeration and Air Conditioning*
b. Althouse, *Modern Refrigeration and Air Conditioning*
c. Delmar, *Principles of Refrigeration*

Student Manuals:

a. Georgia, *Refrigeration*, *Unit REF-14*
b. Copeland Manuals

Tools and Equipment:

a. Gauge and manifold set
b. Refrigeration system
c. Freon
d. Safety glasses
e. Assorted tools

LAB HOURS 4

CLASS HOURS 2

EVALUATION (RF-12)

a. Given the proper tools and equipment, the student will properly install gauges on an operating system and measure system pressures. Readings must be within 5% of actual conditions.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

RF-12 Installing and using refrigeration manifold gauges

PERFORMANCE OBJECTIVE

Install and use refrigeration manifold gauges.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Use of manifold and gauge set
b. Installing manifold gauge
c. Purging
d. Positioning of service valve systems
e. Checking pressure drops
f. Safety hazards

Provide Demonstration On:

a. Installing and removing gauges and hoses
b. Reading gauges

Provide Practical Application On:

Installing and removing gauges on a refrigeration system

INSTRUCTIONAL MATERIALS

Textbooks:

a. Prentice-Hall, Refrigeration and Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Delmar, Principles of Refrigeration

Student Manuals:

a. Georgia, Refrigeration, Unit REF-14
b. Copeland Manuals

Tools and Equipment:

a. Gauge and manifold set
b. Refrigeration system
c. Freon
d. Safety glasses
e. Assorted tools

LAB HOURS 4
CLASS HOURS 2

EVALUATION (RF-12)

a. Given the proper tools and equipment, the student will properly install gauges on an operating system and measure system pressures. Readings must be within 5% of actual conditions.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

RF-12 Installing and using refrigeration manifold gauges

PERFORMANCE OBJECTIVE

Install and use refrigeration manifold gauges.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Use of manifold and gauge set
b. Installing manifold gauge
c. Purging
d. Positioning of service valve systems
e. Checking pressure drops
f. Safety hazards

Provide Demonstration On:

a. Installing and removing gauges and hoses
b. Reading gauges

Provide Practical Application On:

Installing and removing gauges on a refrigeration system

INSTRUCTIONAL MATERIALS

Textbooks:

a. Prentice-Hall, *Refrigeration and Air Conditioning*
b. *Althouse, Modern Refrigeration and Air Conditioning*
c. Delmar, *Principles of Refrigeration*

Student Manuals:

a. Georgia, *Refrigeration*, Unit REF-14
b. Copeland Manuals

Tools and Equipment:

a. Gauge and manifold set
b. Refrigeration system
c. Freon
d. Safety glasses
e. Assorted tools

LAB HOURS 4
CLASS HOURS 2

EVALUATION (RF-12)

a. Given the proper tools and equipment, the student will properly install gauges on an operating system and measure system pressures. Readings must be within 5% of actual conditions.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

RF-12 Installing and using refrigeration manifold gauges

PERFORMANCE OBJECTIVE

Install and use refrigeration manifold gauges.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Use of manifold and gauge set
b. Installing manifold gauge
c. Purging
d. Positioning of service valve systems
e. Checking pressure drops
f. Safety hazards

Provide Demonstration On:

a. Installing and removing gauges and hoses
b. Reading gauges

Provide Practical Application On:

Installing and removing gauges on a refrigeration system

INSTRUCTIONAL MATERIALS

Textbooks:

a. Prentice-Hall, *Refrigeration and Air Conditioning*
b. Althouse, *Modern Refrigeration and Air Conditioning*
c. Delmar, *Principles of Refrigeration*

Student Manuals:

a. Georgia, *Refrigeration*, Unit REF-14
b. Copeland Manuals

Tools and Equipment:

a. Gauge and manifold set
b. Refrigeration system
c. Freon
d. Safety glasses
e. Assorted tools

LAB HOURS 4
CLASS HOURS 2

EVALUATION (RF-12)

a. Given the proper tools and equipment, the student will properly install gauges on an operating system and measure system pressures. Readings must be within 5% of actual conditions.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

RF-13 Evacuating a refrigeration system

PERFORMANCE OBJECTIVE

Use a vacuum pump to evacuate a refrigeration system.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Absolute pressure
b. Noncondensables
c. Low vacuum
d. High vacuum
e. Micron
f. Evacuation
g. Vacuum
h. Single state pump
i. Two state pump
j. Mercury monometer
k. Vacuum pump oil
l. Reasons for evacuating a refrigeration system
m. Effects of moisture on a refrigeration system
n. Effects of air in a refrigeration system

(Continued on back)

Provide Demonstration On:

Procedures for evacuating a refrigeration system

Provide Practical Application On:

Evacuating a refrigeration system until all moisture and air are eliminated from the system

INSTRUCTIONAL MATERIALS

Textbooks:

a. Prentice-Hall, Refrigeration and Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Delmar, Principles of Refrigeration

A/Vs:

Georgia, "Using a Vacuum Pump," slide/tape REF-15

Student Manuals:

a. Georgia, Refrigeration, Unit REF-15
b. Carrier, GTR Manuals
c. Copeland Manuals

Tools and Equipment:

a. Refrigeration system
b. Two stage vacuum pump
c. Manifold and gauge set
d. Freon
e. Assorted tools

LAB HOURS	12
CLASS HOURS	3

EVALUATION (RF-13)

a. Given a refrigeration unit and proper equipment, the student will perform a multiple evacuation procedure and a deep vacuum procedure. All work must be to manufacturer's specifications.

b. Georgia, Refrigeration, Instructor Guide, Vol. IV, 1980.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

o. Ambient temperature
p. Types of vacuum indicators
q. Pressure measurement
r. Inches of mercury measurement
s. Acid
t. Gauges

TASK

RF-14 Installing refrigeration accessories

PERFORMANCE OBJECTIVE

Install in-line accessories according to manufacturer's specifications.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Absorb-adsorb
b. Back pressure regulators
c. Crankcase pressure regulators
d. Desiccant
e. Drier
f. Liquid line valve
g. Liquid indicator
h. Liquid line filter drier
i. Moisture indicator
j. Pump down valve
k. Receiver
l. Suction line accumulator
m. Suction line filter-drier
n. Vibration eliminator
o. Function of accessories
p. Installation of accessories

Provide Demonstration On:

Correct procedures for removing and replacing all components of the refrigeration system

Provide Practical Application On:

a. Installing a liquid indicator with flare-fittings
b. Installing a filter-drier with sweat fittings
c. Installing a capillary tube into a filter-drier
d. Pumping the system down
e. Testing leaks

INSTRUCTIONAL MATERIALS

Textbooks:

a. Prentice-Hall, *Refrigeration and Air Conditioning*
b. Althouse, *Modern Refrigeration and Air Conditioning*
c. Delmar, *Principles of Refrigeration*

A/Vs:

Georgia, "Installing Refrigeration Accessories," slide/tape REF-16

Student Manuals:

a. Georgia, *Refrigeration*, Unit REF-16
b. Copeland Manuals
c. Carrier, *GTR Manuals*

Tools and Equipment:

a. Refrigeration system
b. Flaring tools
c. Assorted hand tools
d. Torch

(Continued on back)

LAB HOURS 14

CLASS HOURS 6

EVALUATION (RF-14)

a. Given a refrigeration unit, accessories and proper tools, the student will remove and replace various accessories and check for leaks. All work must be according to industry practices.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

e. Refrigeration system components
f. Gauge and manifold set
g. Leak detector
h. Safety glasses

TASK

RF-15 Testing for leaks

PERFORMANCE OBJECTIVE

Test for leaks by using soap bubbles, halide torch and an electronic detector.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Methods used in leak detection
b. Pressurizing the system
   1. Freon
   2. Dry nitrogen
c. Devices used in detecting leaks
d. Effect of leaks on the vacuum
e. Repairing leaks

Provide Demonstration On:

a. Testing for leaks using various methods
b. Repairing leaks

Provide Practical Application On:

Leak testing with various leak testing devices

INSTRUCTIONAL MATERIALS

Textbooks:

a. Prentice-Hall, Refrigeration and Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Delmar, Principles of Refrigeration

A/Vs:

Georgia, "Testing for Leaks," slide/tape REF-17

Student Manuals:

a. Georgia, Refrigeration, Unit REF-17
b. Copeland Manuals
c. Carrier, GTR Manuals

Tools and Equipment:

a. Refrigeration system
b. Freon and dry nitrogen
c. Leak detectors
d. Gauges and manifold set
e. Assorted hand tools
f. Safety glasses

LAB HOURS 3

CLASS HOURS 1

EVALUATION (RF-15)

Given the proper equipment and a leaking refrigeration system, the student will test for leaks using (1) the "soap bubble" method, (2) a halide torch, (3) an electronic detector. All leaks must be detected.

TASK

RF-16 Charging the system

PERFORMANCE OBJECTIVE

Charge a refrigeration system by vapor and by liquid.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Handling refrigerants
b. Nameplate data
c. Charging methods
    1. Sight glass method
    2. Frost back method
    3. Vapor charging
    4. Liquid charging
    5. Weigh in method
    6. Ambiant temperature method
    7. Super heat method
d. Manufacturer's charts
e. Capillary and T.E.V. systems

Provide Demonstration On:

Various charging methods

Provide Practical Application On:

Charging the refrigeration system (Capillary and T.E.V. systems)

INSTRUCTIONAL MATERIALS

Textbooks:

a. Prentice-Hall, Refrigeration and Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Delmar, Principles of Refrigeration

A/Vs:

a. Georgia, "Charging the System," slide/tape REF-18

(Continued on back)

Student Manuals:

a. Georgia, Refrigeration, Unit REF-18
b. Copeland Manuals
c. Carrier, GTR Manuals

Tools and Equipment:

a. Refrigeration systems
b. Manifold and gauge set
c. Freon
d. Thermometer

(Continued on back)

LAB HOURS 3

CLASS HOURS 1

EVALUATION (RF-16)

a. Given proper equipment and materials, the student will charge a refrigeration system using the vapor method, the liquid method and the ambient temperature method. Procedures must be according to manufacturer's specifications. All pressure readings must be within given specifications.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

INSTRUCTIONAL MATERIALS

A/Vs:

b. Westinghouse, "STV-GSI Program," slide/tape

Tools and Equipment:

e. Assorted hand tools
f. P.T. chart
g. Safety glasses

TASK

RF-17 Testing the compressor

PERFORMANCE OBJECTIVE

Troubleshoot and replace a refrigerator compressor.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. A reciprocal compressor
b. Rotary compressor
c. Centrifugal compressor
d. Screw type compressor
e. Hermetic compressor
f. Semi-hermetic compressor
g. Open type compressor
h. Testing the compressor
i. Diagnosing problems in compressors

Provide Demonstration On:

a. Compressor types
b. Troubleshooting and replacement procedures

Provide Practical Application On:

Diagnosing problems and repairing various compressors

INSTRUCTIONAL MATERIALS

Textbooks:

a. Prentice-Hall, Refrigeration and Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Delmar, Principles of Refrigeration

A/Vs:

(Continued on back)

Student Manuals:

a. Georgia, Refrigeration, Unit REF-19
b. Copeland Manuals
c. Carrier, GTR Manuals

Tools and Equipment:

a. Compressors
b. Electric meters
c. Manifold and gauge set
d. Assorted hand tools

(Continued on back)

LAB HOURS	4
CLASS HOURS	2

EVALUATION (RF-17)

a. Given an open type, semi-hermetic and hermetic faulty compressors and proper tools, the student will diagnose problems in the compressors and will remove and replace the faulty compressors. Diagnosis must be 100% accurate.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

INSTRUCTIONAL MATERIALS

A/Vs:

a. Georgia, "Testing the Compressor," slide/tape REF-19
b. Carrier, "GTR Refrigeration Program," slide/tape

Tools and Equipment:

e. Refrigerant
f. Safety glasses

TASK

RF-18 Troubleshooting condensers

PERFORMANCE OBJECTIVE

Diagnose and replace faulty condensers.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Air cooled condenser (natural draft)
b. Air cooled condenser (forced draft)
c. Air cooled condenser (forced air, remote)
d. Water cooled condenser (shell and tube)
e. Water cooled condenser (tube within a tube)
f. Water cooled condenser (evaporative)
g. Piping layouts
h. Diagnosing condenser problems

Provide Demonstration On:

a. Various types of condensers
b. Troubleshooting techniques
c. Replacement procedures

Provide Practical Application On:

a. Troubleshooting problems in various types of condensers
b. Removal and replacement of condensers

INSTRUCTIONAL MATERIALS

Textbooks:

a. Prentice-Hall, Refrigeration and Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Delmar, Principles of Refrigeration

A/Vs:

Carrier, "GTR Refrigeration Program," slide/tape

Student Manuals:

a. Georgia, Refrigeration, Unit REF-20
b. Copeland Manuals
c. Carrier, GTR Manuals

Tools and Equipment:

a. Various types of condensers
b. Assorted tools
c. Test instruments

LAB HOURS 6

CLASS HOURS 2

EVALUATION (RF-18)

a. Given various types of faulty condensers, tools and test equipment, the student will diagnose problems and will remove and replace faulty condensers.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

c. V'TECS, Appliance Repairer, Task No. 58.

TASK

RF-19 Troubleshooting evaporators

PERFORMANCE OBJECTIVE

Diagnose and replace faulty evaporators.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. The function of evaporators
b. Fin type evaporators
c. Flooded type evaporators
d. Diagnosing malfunctions
e. Removal and replacement procedures

Provide Demonstration On:

a. Types of evaporators
b. Troubleshooting techniques
c. Replacement procedures

Provide Practical Application On:

a. Troubleshooting problems in various types of evaporators
b. Removal and replacement of evaporators

INSTRUCTIONAL MATERIALS

Textbooks:

a. Prentice-Hall, Refrigeration and Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Delmar, Principles of Refrigeration

A/Vs:

Carrier, "GTR Refrigeration Program," slide/tape

Student Manuals:

a. Georgia, Refrigeration Unit REF-21
b. Copeland Manuals
c. Carrier, GTR Manuals

Tools and Equipment:

a. Refrigeration systems
b. Manifold and gauge set
c. Freon
d. Leak detector
e. Torch and solder
f. Assorted tools

LAB HOURS	6
CLASS HOURS	2

EVALUATION (RF-19)

a. Given a faulty evaporator and proper tools and equipment, the student will diagnose problems and will repair or replace the evaporator. All work must be in accordance with industry standards.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

c. V'TECS, Appliance Repairer, Task No. 60.

TASK

RF-20 Troubleshooting ar automatic expansion valve

PERFORMANCE OBJECTIVE

Diagnose and correct malfunctions in automatic expansion valves.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. The functioning of A.E.V.
b. Improper adjustment
c. Moisture in the valve
d. Moisture in the bellows or diaphragm
e. Components of the valve
f. Diagnostic techniques
g. Adjustment procedures
h. Replacement procedures

Provide Demonstration On:

a. Diagnostic techniques
b. Adjustment procedures

Provide Practical Application On:

a. Disassembling, inspecting and reassembling A.E.V.
b. Removing, replacing and adjusting A.E.V.

INSTRUCTIONAL MATERIALS

Textbooks:

a. Prentice-Hall, Refrigeration and Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Delmar, Principles of Refrigeration

Student Manuals:

a. Georgia, Refrigeration, Unit REF-22

(Continued on back)

Tools and Equipment:

a. Automatic expansion valves
b. Refrigeration system with the A.E.V.
c. Manifold and gauge set
d. Assorted handtools
e. Freon

LAB HOURS	3
CLASS HOURS	1

EVALUATION (RF-20)

a. Given a refrigeration system with a faulty automatic expansion valve, the student will diagnose faulty operation in the valve and will replace the valve. Fault must be identified and installation procedures must be to manufacturer's specifications.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

INSTRUCTIONAL MATERIALS:

Student Manuals:

b. Copeland Manuals
c. Carrier, GTR Manuals

TASK

RF-21 Troubleshooting capillary tubes

PERFORMANCE OBJECTIVE

Identify, remove and replace or repair facility capillary tubes.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. The function of the capillary system
b. Capillary tube applications
c. Diagnosing faulty operation
d. Removal and replacement procedures
e. Sizing the tube system
f. Types of motors used on the capillary system
g. Correct freon charge

Provide Demonstration On:

a. Properly and improperly functioning capillary systems
b. Removal and replacement procedures

Provide Practical Application On:

a. Diagnosing faulty capillary functioning
b. Using a hydraulic tester
c. Removing and replacing capillary tube systems

INSTRUCTIONAL MATERIALS

Textbooks:

a. Prentice-Hall, *Refrigeration and Air Conditioning*
b. Althouse, *Modern Refrigeration and Air Conditioning*
c. Delmar, *Principles of Refrigeration*

Student Manuals:

a. Georgia, *Refrigeration*, Unit REF-23
b. Copeland Manuals
c. Carrier, *GTR Manuals*

Tools and Equipment:

a. Capillary tubes
b. Manifold and gauge set
c. Torch and solder
d. Freon
e. Drier
f. Assorted hand tools

LAB HOURS 3

CLASS HOURS 1

EVALUATION (RF-21)

a. Given a refrigeration system with a restriction in the capillary tubes, the student will properly diagnose the malfunction and repair or replace the capillary system. Diagnosis must be exact and repairs must be according to industry standards.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

RF-22 Troubleshooting thermostatic expansion valves

PERFORMANCE OBJECTIVE

Diagnose, repair or remove/replace faulty thermostatic expansion valves.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of thermostatic expansion valves
b. Location
c. Functioning
d. Sub-cooling
e. Component parts
f. Bulb location and installation
g. External equalizer connection
h. Driers, strainers and accessories
i. Test pressures and dehydration temperatures
j. Determining superheat
k. Malfunctions
l. Repairing the valve

(Continued on back)

Provide Demonstration On:

a. Types of T.E.V.
b. Diagnostic techniques
c. Repair and replacement procedures

Provide Practical Application On:

a. Diagnosing faulty T.E.V. functioning
b. Repair and adjustment procedures
c. Removal and replacement procedures

INSTRUCTIONAL MATERIALS

Textbooks:

a. Prentice-Hall, Refrigeration and Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Delmar, Principles of Refrigeration

A/Vs:

Georgia, "Troubleshooting a Thermostatic Expansion Valve," slide/tape REF-24

Student Manuals:

a. Georgia, Refrigeration, Unit REG-24
b. Copeland Manuals
c. Carrier, GTR Manuals

Tools and Equipment:

a. T.E.V. refrigerator system
b. Assorted T.E.V.
c. Manifold and gauge set
d. Freon
e. Drier
f. Assorted tools

LAB HOURS 2

CLASS HOURS 2

EVALUATION (RF-22)

a. Given a refrigeration system with faulty functioning of the thermostatic expansion valve, the student will properly diagnose the malfunction and will repair or remove/replace the T.E.V. All work must be in accordance with industry standards.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

m. Valve setting
n. Evaporating temperature
o. Thermostatic change
p. Internal and external equalizer
q. Pumping down the T.E.V. system

TASK

RF-23 Troubleshooting the refrigeration system

PERFORMANCE OBJECTIVE

Diagnose and repair malfunctions in refrigeration systems.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Troubleshooting from symptoms
b. Types of compressor failure
c. Types of condenser failure
d. Types of evaporator failure
e. Refrigerant leaks
f. Capillary tube failure
g. Low charge and high charge
h. Non-condensables
i. A.E.B. failure
j. T.E.V. failure
k. Troubleshooting tables

Provide Demonstration On:

Troubleshooting techniques

Provide Practical Application On:

Diagnosing and repairing various problems in refrigeration systems

INSTRUCTIONAL MATERIALS

Textbooks:

a. Prentice-Hall, Refrigeration and Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Delmar, Principles of Refrigeration

Student Manuals:

a. Georgia, Refrigeration, Unit REF-25
b. Copeland Manuals
c. Carrier, GTR Manuals

Tools and Equipment:

a. Refrigerator systems
b. Manifold and gauge set
c. Freon
d. Test meters
e. Leak detector
f. Assorted tools

LAB HOURS	6
CLASS HOURS	2

EVALUATION (RF-23)

a. When presented with refrigeration systems having malfunctions, the student will accurately diagnose and repair the malfunctions so that the systems are fully operational.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

c. V'TECS, Appliance Repairer, Task No. 104.

TASK

RF-24 Installing a window air conditioning unit

PERFORMANCE OBJECTIVE

Install a window air conditioning unit according to manufacturer's specifications.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Air conditioner parts
b. Window parts
c. Tools to be used
d. Installation checkpoints
    1. Adequate wiring and fuses
    2. Drainage slope
    3. Secure placement
    4. Window lock
    5. Air leaks
    6. Filter
    7. Correct operation of unit
e. Annual maintenance

Provide Demonstration On:

Correct installation procedures

Provide Practical Application On:

Installing a window air conditioner in an existing or mock-up window

INSTRUCTIONAL MATERIALS

Textbooks:

a. Delmar, Principles of Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Prentice-Hall, Refrigeration and Air Conditioning

A/Vs:

Georgia, "Installation of a Window Unit," slide/tape AC-06, REF-26A

Student Manuals:

Georgia, Air Conditioning: Post Secondary, Unit AC-06; Refrigeration: Secondary, Unit REF-26

Tools and Equipment:

a. Assorted hand tools
b. Permagum
c. Safety-glasses
d. Window air conditioner
e. Mock-up window

LAB HOURS	8
CLASS HOURS	2

EVALUATION (RF-24)

a. Given a window air conditioning unit and assorted tools, the student will install the unit in a window according to manufacturer's specifications and in accordance with standard practice.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

c. V'TECS, Appliance Repairer, Task No. 1.

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TASK

RF-25 Performing pre-season start up maintenance on window air conditioning units

PERFORMANCE OBJECTIVE

Inspect and perform pre-season start-up maintenance for an air conditioning window unit.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. When and why to perform pre-season start-up maintenance
b. Typical problems
    1. Rotton wood around window
    2. Cracks in seals and windows
    3. Water leaks
    4. Dirty filter
    5. Dirty coils
    6. Tilt of unit
    7. Condition of braces
    8. Condition of receptacle and cord

(continued on back)

Provide Demonstration On:

Routine procedures and special problems

Provide Practical Application On:

Performing a pre-season start-up maintenance on a window unit

INSTRUCTIONAL MATERIALS

Textbooks:

a. Delmar, Principles of Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Prentice-Hall, Refrigeration and Air Conditioning

A/Vs:

Georgia, "Performing Pre-Season Start-Up," slide/tape AC-07, REF-27a

Student Manuals:

Georgia, Air Conditioning: Post Secondary, Unit AC-07; Refrigeration: Secondary, Unit REF-27

Tools and Equipment:

a. Assorted hand tools
b. Seals, filters, permagum pre-season maintenance

LAB HOURS	8
CLASS HOURS	2

EVALUATION (RF-25)

a. Given a window air conditioning unit in need of pre-season maintenance, the student will preform maintenance required according to manufacturer's specifications.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

c. Maintenance steps
   1. Removing unit
   2. Oiling fan motor
   3. Wraping fan motor in plastic
   4. Cleaning coils
   5. Straightening fins
   6. Cleaning evaporator drains
   7. Repairing bracing
   8. Tilting unit properly
   9. Repairing rotton wood
   10. Repairing or replacing damaged or missing seals
   11. Reinstalling unit
   12. Cleaning filter
   13. Repairing cord
   14. Repairing receptacle
   15. Starting-up and running
   16. Checking inlet and outlet temperatures
   17. Repairing water leaks
   18. Cleaning area
   19. Informing customer of maintenance procedures

TASK

RF-26 Troubleshooting compressor burnout in window air conditioners

PERFORMANCE OBJECTIVE

Diagnose a burned out compressor in a window air conditioner and replace with a functioning compressor.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of burnout
b. Causes of burnout
c. Diagnosing burnout
d. Acidic oil
e. Replacing a burned out compressor
f. Bleeding the refrigerant
g. Removing and replacing drier or filter and capillary tubes
h. Flushing the evaporator and condensor
i. Evacuating the system
j. Charging the system

Provide Demonstration On:

a. Correct use of test instruments
b. Charging out compressors
c. Evacuating and charging the system

Provide Practical Application On:

a. Diagnosing different types of burnout
b. Replacement of a burned out compressor in a window unit

INSTRUCTIONAL MATERIALS

Textbooks:

a. Delmar, Principles of Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Prentice-Hall, Refrigeration and Air Conditioning

A/Vs:

Georgia, "Troubleshooting Compressor Burn Out in a Window Air Conditioner," slide/tape AC-08a, AC-08b, REF-28a, REF-28b

Student Manuals:

Georgia, Air Conditioning: Post Secondary, Unit AC-08; Refrigeration: Secondary, Unit REF-28

Tools and Equipment:

a. Burned out and functional compressors
b. VOM, amprobe
c. Vacuum pump
d. Freon

(Continued on back)

LAB HOURS	8
CLASS HOURS	2

EVALUATION (RF-26)

a. Given a window air conditioner with a burned out compressor, the student will accurately diagnose the nature of the burnout and will replace the burnout with a functional compressor. The system must operate within manufacturer's specifications.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

INSTRUCTIONAL ACTIVITIES

Tools and Equipment:

e. Assorted hand tools
f. Compressor test cord
g. Capillary tubes
h. Filter/drier

TASK

RF-27 Evacuating and charging window air conditioners

PERFORMANCE OBJECTIVE

Evacuate and charge a window air conditioner using both the temperature, touch and pressure method and the dial-a-charge method.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. When evacuation and charging are preformed
b. Removing all the freon
c. Evacuating the system to 500 microns
d. Breaking the vacuum to zero PSIG with freon vapor
e. Charging the system by coil temperature and dial-a-charge methods
f. Checking the system for peak performance
g. Possible safety hazards

Provide Demonstration On:

a. Use of the vacuum pump
b. Charging the system with freon
c. Recognizing when a system is fully charged

Provide Practical Application On:

Evacuating and charging a window unit using the temperature, pressure and touch method and the dial-a-charge method

INSTRUCTIONAL MATERIALS

Textbooks:

a. Delmar, Principles of Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Prentice-Hall, Refrigeration and Air Conditioning

A/Vs:

Georgia, "Evacuating and Charging a Window Air Conditioner," slide/tape AC-09a, AC-09b, REF-29a, REF-29b

Student Manuals:

Georgia, Air Conditioning: Post Secondary, Unit AC-09; Refrigeration: Secondary, Unit REF-29

Tools and Equipment:

a. A window air conditioner to be evacuated and charged
b. Vacuum pump and gauges
c. Freon

(Continued on back)

LAB HOURS 8

CLASS HOURS 2

EVALUATION (RF-27)

a. Given a window air conditioner unit, freon, vacuum pump, gauges and the proper tools, the student will evacuate and recharge the system using both the temperature, pressure and touch method and the dial-a-charge method. The system vacuum, pressures and temperature must be within manufacturer's specifications.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

d. Thermometers
e. Drier
f. Hand tools

TASK

RF-28 Troubleshooting fans and fan motors

PERFORMANCE OBJECTIVE

Diagnose, remove and replace a defective fan and motor in a window air conditioner.

INSTRUCTIONAL ACTIVITIES

Provide Infromation On:

a. Use of shaded-pole and PSC motors
b. Reading motor schematics
c. Types of mechanical failure
d. Types of electrical failure
e. Operational symptoms of failure
f. Testing for shorts, opens and grounds using the VOM
g. Using the "direct test" method
h. Removing and replacing faulty motors

Provide Demonstration On:

a. Examples of mechanical and electrical failure in fans and motors
b. Testing with the VOM
c. "Direct test" method

Provide Practical Application On:

a. Using the VOM to diagnose electrical failure in defective fan motors
b. Using the "direct test" to diagnose electrical failure in defective motors
c. Removing and replacing a fan motor in a window unit

INSTRUCTIONAL MATERIALS

Textbooks:

a. Delmar, Principles of Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Prentice-Hall, Refrigeration and Air Conditioning

A/Vs:

Georgia, "Troubleshooting Fans and Fan Motors," slide/tape AC-10a, AC-10b, REF-30a, REF-30b

Student Manuals:

Georgia, Air Conditioning: Post Secondary, Unit AC-10 Refrigeration: Secondary, Unit REF-30

Tools and Equipment:

a. Fan motors with various defects
b. Window air conditioner unit
c. Replacement fan motor

(Continued on back)

LAB HOURS 6

CLASS HOURS 2

EVALUATION (RF-28)

a. Given a window air conditioner unit with a faulty fan motor, the student will diagnose the fault and remove and replace the fan motor. The unit must operate according to manufacturer's specifications.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

c. V'TECS, Appliance Repairer, Task No. 35.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

d. Direct test leads
e. VOM Amprobe
f. Assorted hand tools

TASK

RF-29 Troubleshooting mechanical problems in window air conditioner refrigeration cycle

PERFORMANCE OBJECTIVE

Accurately diagnose and correct mechanical problems in the refrigeration cycle of window air conditioners.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. The most common problems
b. External indicators
    1. Dirty evaporator or condenser
    2. Air temperature drop across evaporator
    3. Evaporator temperature
    4. Suction line temperature
    5. Discharge line temperature
    6. Condenser liquid line temperature
    7. Capillary tube temperature

(Continued on back)

Provide Demonstration On:

a. Indicators of proper functioning
b. Entering the refrigeration system
c. Proper use of test instruments

Provide Practical Application On:

Diagnosing and repairing a window air conditioner with a mechanical problem in the refrigeration cycle

INSTRUCTIONAL MATERIALS

Textbooks:

a. Delmar, Principles of Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Prentice-Hall, Refrigeration and Air Conditioning

A/Vs:

Georgia, "Troubleshooting Window Air Conditioner Refrigeration Cycle," slide/tape AC-11a, REF-31a

Student Manuals:

Georgia, Air Conditioning: Post Secondary, Unit AC-11; Refrigeration: Secondary, Unit REF-31

Tools and Equipment:

a. Window air conditioner with refrigeration fault
b. Replacement parts, Shrader valves
c. Freon and gauges

(Continued on back)

LAB HOURS	6
CLASS HOURS	2

EVALUATION (RF-29)

a. Given the proper test instruments, repair equipment and a window air conditioner unit with a fault in the mechanical refrigeration cycle, the student will diagnose and repair the problem. The unit must operate within manufacturer's specification.

b. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

c. Entering the system
   1. Type of service valves
   2. Discharge pressure
   3. Suction pressure

d. Using the refrigeration cycle charts

INSTRUCTIONAL MATERIALS

Tools and Equipment:

d. Thermometers
e. Torch
f. Air and brushed for cleaning
g. Assorted tools

TASK

RF-30 Troubleshooting a window air conditioner electrical system

PERFORMANCE OBJECTIVE

Correctly diagnose electrical problems in window air conditioning units.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Identifying all electricla components
b. Reading wiring diagrams
c. Testing components with the VOM and amprobe
    1. Fan motor
    2. Compressor
    3. Mainswitch
    4. Thermostat
    5. Overload
    6. Capacitors
d. Checking line voltage
e. Checking receptacle and wiring
f. Checking fuses

Provide Demonstration On:

Testing with the amprobe and VOM

Provide Practical Application On:

Diagnosing electrical problems in window air conditioner units

INSTRUCTIONAL MATERIALS

Textbooks:

a. Delmar, Principles of Air Conditioning
b. Althouse, Modern Refrigeration and Air Conditioning
c. Prentice-Hall, Refrigeration and Air Condditioning

A/Vs:

Georgia, "Troubleshooting a Window Air Conditioning Electrical System," slide/tape AC-12a, AC-12b, REF-32a, REF-32b

Student Manuals:

Georgia, Air Conditioning: Post Secondary, Unit AC-12; Refrigeration: Secondary, Unit REF-32

Tools and Equipment:

a. Window air conditioning units with electrical faults
b. VOM
c. Assorted tools
d. Amprobe

LAB HOURS 6

CLASS HOURS 2

EVALUATION (RF-30)

a. Given a number of window air conditioners with various electrical problems, the student will locate the problem and describe the cause with 100% accuracy.

b. Georgia, Electro-Mechanical, Insturctor Guide, Vol. IV, 1980.

TASK

RF-31 Identifying and describing the function of the refrigeration components

PERFORMANCE OBJECTIVE

Identify and describe the function of the basic components of the refrigeration cycle.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Compressor (reciprocal and rotary)
b. Oil-cooler
c. Discharge line
d. Condenser (forced air and static)
e. Liquid line
f. Filter-dryer
g. Metering device
h. Evaporator (shell, fin, shelf)
i. Suction line
j. Freezers (chest and upright)
k. Refrigerators

Provide Demonstration On:

a. Identifying components on refrigerators and freezers
b. Describing function of each component

Provide Practical Application On:

a. Locating the components on a refrigerator and a freezer
b. Writing a brief description of each component

INSTRUCTIONAL MATERIALS

Textbooks:

Prentice-Hall, Refrigeration and Air Conditioning

A/Vs:

Georgia, "Understanding Basic Operation," slide/tape REF-33a REF-33b

Student Manuals:

a. Georgia, Refrigeration: Secondary, Units REF-33
b. MAVCC, Air Conditioning and Refrigeration, Book Two

Tools and Equipment:

a. All basic refrigeration, components
b. Refrigeration cut-a-way
c. Charts and diagrams of system

LAB HOURS 8

CLASS HOURS 2

EVALUATION (RF-31)

a. Given a refrigerator or freezer, the student will identify all refrigeration components and write a short description and function of each. One hundred percent accuracy is required.

b. MAVCC, Air Conditioning and Refrigeration, Teacher Edition, Book Two, 1977.

c. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

RF-32 Evacuating and charging domestic refrigerator and freezer systems

PERFORMANCE OBJECTIVE

Evacuate and charge refrigerator system.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Installing access valves (styles and types)
b. Triple evacuation
c. Deep evacuation
d. Purpose of evacuation
e. Safety while handling refrigerants
f. Charging with liquid
g. Charging with vapor
h. Sealing the system
i. Testing for leaks

Provide Demonstration On:

Going through complete evacuation and charging procedures on a refrigerator or freezer

Provide Practical Application On:

Evacuating and charging a refrigerator or freezer by liquid and vapor method.

INSTRUCTIONAL MATERIALS

Textbooks:

Prentice-Hall, Refrigeration and Air Conditioning

A/Vs:

Georgia, "Evacuating and Charging Refrigerators and Freezers," slide/tape REF-34a

Student Manuals:

a. Georgia, Refrigeration: Secondary, Unit REF-34
b. MAVCC, Air Conditioning and Refrigeration, Book One

Tools and Equipment:

(Continued on back)

LAB HOURS	12
CLASS HOURS	4

EVALUATION (RF-32)

a. Given a refrigerator or freezer and necessary tools and equipment, the student will evacuate, charge and leak test the system. The amount of refrigerant and depth of evacuation must be within manufacturer's specifications. All leaks, if any, must be detected.

b. MAVCC, Air Conditioning and Refrigeration, Teacher Edition, Book One, 1977.

c. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

a. Access valves
b. Refrigerator system
c. Vacuum pump
d. Manifold gauge
e. Refrigerant
f. Safety glasses
g. High vacuum gauge
h. Leak detector (electronic and halide torch)
i. Soap
j. Pinch off tool and soldering equipment

TASK

RF-33 Testing and replacing the refrigeration cycle components

PERFORMANCE OBJECTIVE

Locate cause(s) of refrigeration cycle failure and replace defective component(s).

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Frost patterns
b. Restrictions
c. Low refrigerant (leaks)
d. Recording temperatures
e. High pressures
f. Low pressures
g. Air leaks (door gasket)
h. Moisture contamination
j. Thermostat problems

Provide Demonstration On:

Locating a known problem in a refrigerator/freezer refrigeration cycle

Provide Practical Application On:

Locating the cause of a refrigeration failure on an operable refrigerator/freezer with known condition

INSTRUCTIONAL MATERIALS

Textbooks:

Althouse, Modern Refrigeration and Air Conditioning

A/Vs:

Georgia, "Troubleshooting Refrigeration Cycle," slide/tape REF-35a

Student Manuals:

a. Georgia, Refrigeration: Secondary, Unit REF-35
b. MAVCC, Air Conditioning and Refrigeration, Book Two

Tools and Equipment:

(Continued on back)

LAB HOURS	14
CLASS HOURS	6

EVALUATION (RF-33)

a. Given a refrigerator or freezer and necessary tools and equipment, the student will identify all refrigeration components and write a short description and function of each. One hundred percent accuracy is required and correct nomenclature must be used.

b. MAVCC, Air Conditioning and Refrigeration, Teacher Edition Book Two, 1877.

c. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

a. Refrigerator with known problem
b. Manifold gauges
c. Leak detection equipment
d. VOM meter
e. Troubleshooting chart
f. Shop manual

TASK

RF-34 Troubleshooting refrigerator/freezer compressor burn out

PERFORMANCE OBJECTIVE

Determine the condition of a compressor motor and the cause of failure.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Excessive heat loads
b. Runs excessively hot
c. Short cycles
d. Low voltage
e. High voltage
f. Mechanical failures
g. Resistance readings on common, start and run terminals

Provide Demonstration On:

Checking the compressor with a VOM

Provide Practical Application On:

Determine the condition of a failed compressor and describe probable cause of failure

INSTRUCTIONAL MATERIALS

Textbooks:

Doolin, Doolin's Troubleshooter's Bible

A/Vs:

Georgia, "Troubleshooting Compressor Burn Out," slide/tape REF-37a

Student Manuals:

a. Georgia, Refrigeration: Secondary, Unit REF-37
b. MAVCC, Air Conditioning and Refrigeration, Book Two

Tools and Equipment:

(Continued on back)

LAB HOURS	8
CLASS HOURS	2

EVALUATION (RF-34)

a. Given a refrigerator or freezer with a defective compressor and necessary tools and equipment, the student will determine if the compressor is serviceable and if not, what caused the burn out. All resistance readings must be within 10% of known conditions and cause of burn must be stated using correct nomenclature.

b. MAVCC, Air Conditioning and Refrigeration, Teacher Edition, Book Two, 1977.

c. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

INSTRUCTIONAL MATERIALS

Tools and Equipment:

a. Different styles of compressors
b. Start-run cord
c. VOM meter
d. Troubleshooting chart
e. Shop manual

TASK

RF-35 Testing and replacing refrigerator/freezer fans and fan motors

PERFORMANCE OBJECTIVE

Test and repair or replace the fans, fan motors, switches and connections.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Function of evaporator fan motor
b. Function of condenser fan motor
c. Restricted or no air switch
d. Checking motor and switch
e. Wiring schematics

Provide Demonstration On:

a. Checking fan motors and switches
b. Interpreting wiring schematics

Provide Practical Application On:

a. Checking out condenser and evaporator fan motors
b. Cleaning or replacing motor switches
c. Checking and replacing motor switches

INSTRUCTIONAL MATERIALS

Textbooks:

Althouse, Modern Refrigeration and Air Conditioning

A/Vs:

Georgia, "Troubleshooting Fans and Fan Motors," slide/tape REF-36a

Student Manuals:

a. Georgia, Refrigeration: Secondary, Unit REF-36
b. MAVCC, Air Conditioning and Refrigeration, Book Two

Tools and Equipment:

a. Refrigerator with wiring schematic attached to back
b. VOM meter
c. Shop manual

LAB HOURS	8
CLASS HOURS	2

EVALUATION (RF-35)

a. Given a refrigerator or freezer and necessary tools and equipment, the student will test all fan motors, determine the condition and replace as necessary. Faulty fan motors must be identified and replaced according to the manufacturer's specifications.

b. MAVCC, Air Conditioning and Refrigeration, Teacher Edition, Book Two, 1977.

c. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

TASK

RF-36 Diagnosing problems in refrigerators and freezers

PERFORMANCE OBJECTIVE

Develop and use a troubleshooting plan for locating problems in a refrigerator or freezer.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Developing and reading troubleshooting charts
b. Reading wiring diagrams
c. Review of refrigeration cycle
d. Testing perimeter
e. Testing switches
f. Defrost timer
g. Temperature control
h. Using torch, sight and hearing to locate problems

Provide Demonstration On:

Developing a comprehensive troubleshooting plan

Provide Practical Application On:

Developing a comprehensive troubleshooting plan and applying it to several refrigerator/freezer systems

INSTRUCTIONAL MATERIALS

Textbooks:

Doolin, Doolin's Troubleshooter's Bible

Student Manuals:

a. Georgia, Refrigeration: Secondary, Unit REF-38
b. MAVCC, Air Conditioning and Refrigeration, Book Two

Tools and Equipment:

a. Refrigerator
b. Troubleshooting charts
c. Diagnostic tools
d. Shop manual

LAB HOURS	8
CLASS HOURS	2

EVALUATION (RF-36)

a. Given a refrigerator or freezer with an unknown malfunction and necessary tools and equipment, the student will develop a troubleshooting plan leading to the cause of failure. The student will recommend needed repairs. The student's recommendation must be the same as the instructor's.

b. MAVCC, Air Conditioning and Refrigeration, Teacher Edition, Book Two, 1977.

c. Georgia, Electro-Mechanical, Instructor Guide, Vol. IV, 1980.

SECTION IV

CURRICULUM STRUCTURE, EXIT POINTS & COURSE OUTLINE

SECTION IV

Section IV Content List

Introduction to the Curriculum Structure
Curriculum Structure
  - Group
  - Individualized

Introduction to Appliance Repair Exit Points
Appliance Repair Exit Points
  - Group
  - Individualized

Introduction to the Course Outline
Course Outline

Section III presented a sample organizational model for sequencing the instruction of program tasks. Based on that model, Section IV provides suggested methods of structuring the entire Appliance Repair curriculum.

INTRODUCTION TO THE CURRICULUM STRUCTURE

A curriculum structure is developed by sequencing duties* into a logical teaching plan. Two curriculum structures are presented in this section - group and individualized.

The group designed structure is based on recommendations of Appliance Repair instructors in Georgia and across the United States. The 1248 program hours is distributed over four quarters assuming that each quarter is approximately 3/2 hours.

The individualized structure also lists the duty areas under major blocks, but does not include hours or quarters. Using the individualized approach, the student proceeds at his or her pace until each task is mastered.

In either type of structure, the duty areas and major blocks can be re-arranged to meet local needs.

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*Duties are large segments of work done by an individual and usually require several tasks to accomplish. They are generally grouped under the major teaching blocks of the program.

APPLIANCE REPAIR SUGGESTED CURRICULUM STRUCTURE*

Course	Class Hours	Lab Hours	Total Hours
Quarter I			
ELECTRICITY:			
Fundamentals	33	63	96
Electric Motors	11	39	50
Appliance Residential Wiring	6	24	30
Blueprint Reading	8	20	28
APPLIANCE INSTALLATION AND REPAIR:			
Install Electric Appliances	28	80	108
	86	226	312
Quarter II			
APPLIANCE INSTALLATION AND REPAIR:			
Install Gas Appliances	30	98	128
Repair Electric Appliances	56	128	184
	86	226	312
Quarter III			
APPLIANCE INSTALLATION AND REPAIR:			
Repair Electric Appliances	22	56	78
Repair Gas Appliances	84	150	234
	106	206	312
Quarter VI			
REFRIGERATION:			
Refrigeration Fundamentals	12	22	34
Tubing and Pipe	6	18	24
Refrigerants	22	50	72
Troubleshooting	12	30	42
Window Air Conditioning	14	50	64
Refrigerators and Freezers	18	58	76
	84	228	312
Total Program Hours	362	886	1248

*This curriculum structure is designed to be used for group instruction.

APPLIANCE REPAIR SUGGESTED CURRICULUM STRUCTURE*

ORIENTATION:
- School Policies and Procedures
- Program Orientation and Safety
- Operation of Audiovisual Equipment
- Using the Learning Resource Center

ELECTRICITY:
- Fundamentals
- Electric Motors
- Appliance Residential Wiring
- Blueprint Reading

APPLIANCE INSTALLATION AND REPAIR:
- Install Electric Appliances
- Install Gas Appliances
- Repair Electric Appliances
- Repair Gas Appliances

REFRIGERATION:
- Refrigeration Fundamentals
- Tubing and Pipe
- Refrigerants
- Troubleshooting
- Window Air Conditioning
- Refrigerators and Freezers

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*This curriculum structure is to be used for individualized instruction.

INTRODUCTION TO APPLIANCE REPAIR
EXIT POINTS

The following diagrams illustrate points in the Appliance Repair program where a student should have acquired competencies necessary for entry level employment.

Both the group and individualized exit point diagrams sequence the Appliance Repair job classifications from least to most difficult. The group exit point diagram illustrates a lock-step process in which students proceed through an entire program at the same pace and exit at approximately the same point in time.

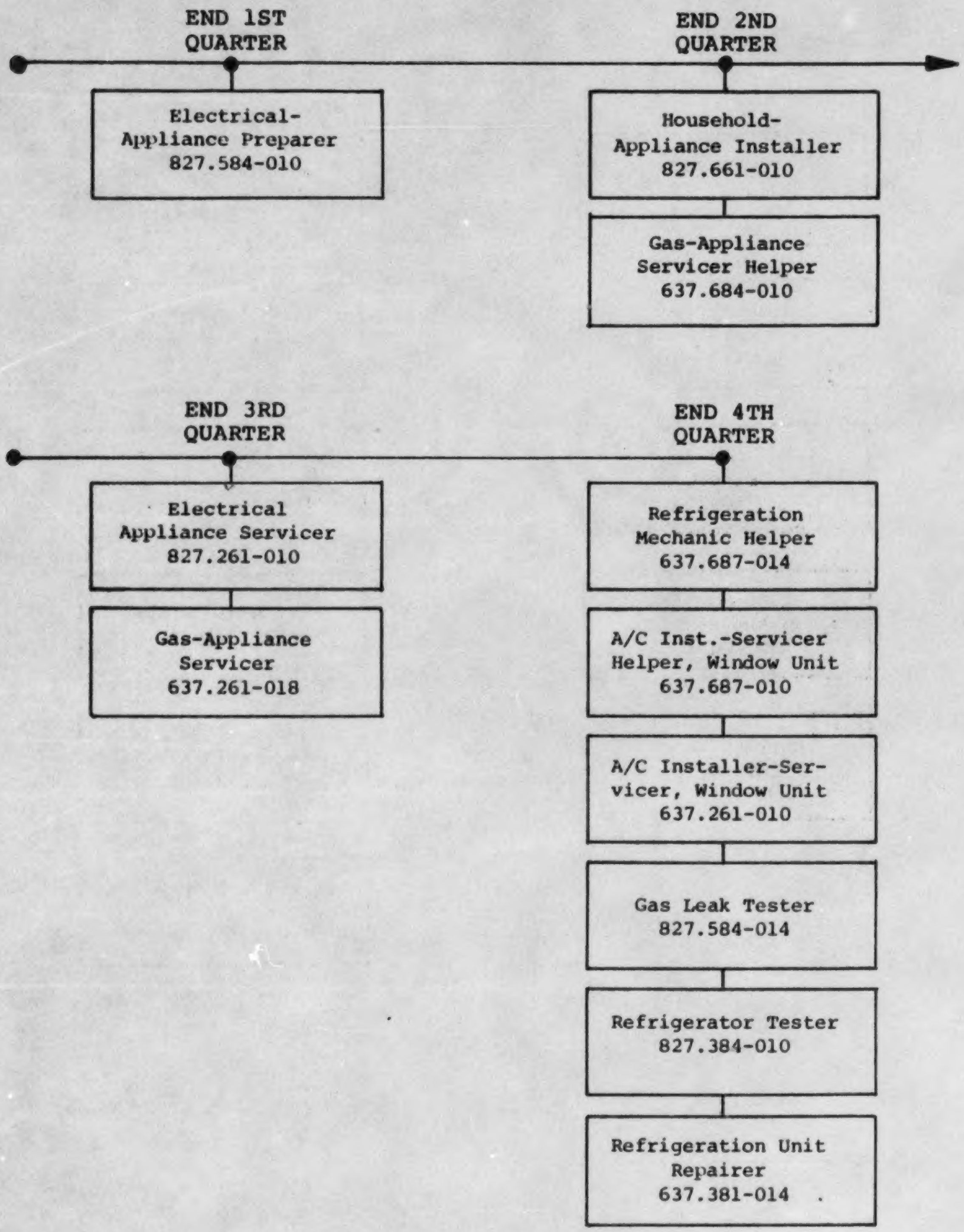
The individualized exit point diagram illustrates a self-paced progression through the Appliance Repair program. This approach permits a student to complete any one or all tasks necessary for entry level employment.

The major difference between the group and individualized approach is the number of tasks a student must master. For example, in the individualized approach, a student desiring employment in a refrigeration repair shop needs to complete only those tasks identified for that job. However, in the group approach, a student must master the tasks in the previous DOT classifications leading to that particular job title.

Both diagrams are based on the preceeding suggested curriculum structures.

APPLIANCE REPAIR

(Group Instruction)


END 1ST QUARTER
END 2ND QUARTER
Electrical-Appliance Preparer 827.584-010
Household-Appliance Installer 827.661-010
Gas-Appliance Servicer Helper 637.684-010
END 3RD QUARTER
END 4TH QUARTER
Electrical Appliance Servicer 827.261-010
Gas-Appliance Servicer 637.261-018
Refrigeration Mechanic Helper 637.687-014
A/C Inst.-Servicer Helper, Window Unit 637.687-010
A/C Installer-Servicer, Window Unit 637.261-010
Gas Leak Tester 827.584-014
Refrigerator Tester 827.384-010
Refrigeration Unit Repairer 637.381-014

APPLIANCE REPAIR

(Individualized Instruction)

Electrical-Appliance Preparer
827.584-010

Household-Appliance-Installer
827.661-010

Gas-Appliance-Servicer Helper
637.684-010

Electrical-Appliance Servicer
827.261-010

Gas-Appliance Servicer
637.261-018

Refrigeration Mechanic Helper
637.687-014

A/C Inst.-Servicer Helper, Window Unit
637.687-010

A/C Installer-Servicer, Window Unit
637.261-010

Gas Leak Tester
827.584-014

Refrigerator Tester
827.384-010

Refrigeration Unit Repairer
637.381-014

INTRODUCTION TO THE COURSE OUTLINE

A course outline suggests a method of sequencing tasks for instruction. In the following outline, tasks are ordered according to duty areas and major blocks. Tasks are then arranged from general to specific knowledge and applications.

Class and lab hours for each task are assigned according to Georgia's appliance repair instructor's recommendations. The time allotments for the three major blocks total 1248 hours. The student spends approximately 70% (886 hours) of total program time in the lab.

The following course outline is designed for group instruction, however, it may be adapted for individualized instruction by eliminating the time sequencing for tasks.

APPLIANCE REPAIR SUGGESTED COURSE OUTLINE

Quarter I

Task	Title	Class Hours	Lab Hours
	MAJOR BLOCK: ELECTRICITY		
	DUTY A: FUNDAMENTALS		
EL-01	Identifying safe working conditions	3	1
EL-02	Using basic electrical theory	2	8
EL-03	Computing Ohm's law and power formulas	2	8
EL-04	Using electric meters	2	6
EL-05	Identifying electrical symbols	4	4
EL-06	Drawing basic schematic diagrams	4	6
EL-07	Laying out and wiring series and parallel circuits	2	6
EL-08	Reading and drawing advanced schematic diagrams	4	6
EL-09	Laying out, wiring and testing an alternating current (AC) circuit	2	6
EL-10	Selecting wire size and making connections	6	6
EL-11	Making main panel connections	2	6
		33	63
	DUTY B: ELECTRIC MOTORS		
EL-12	Installing and testing shaded pole motors	1	5
EL-13	Installing and testing split phase motors	1	5
EL-14	Checking capacitors for serviceability	1	3
EL-15	Installing and testing permanent split capacitor (PSC) motors	1	5
EL-16	Installing and testing capacitor start (CS) motors	1	5
EL-17	Installing and testing capacitor start/run (CSR) motors	2	4
EL-18	Troubleshooting electric motors	2	6
EL-19	Servicing electric motors	2	6
		11	39
	DUTY C: APPLIANCE RESIDENTIAL WIRING		
EL-20	Installing 115 volt AC appliance circuits	2	8
EL-21	Installing split switched receptacles	2	8
EL-22	Installing 230 volt AC appliance circuits	2	8
		6	24

Task	Title	Class Hours	Lab Hours
	DUTY D: BLUEPRINT READING		
EL-23	Using standard measurements	4	8
EL-24	Identifying and drawing electrical symbols	4	12
		8	20
	MAJOR BLOCK: APPLIANCE INSTALLATION AND REPAIR		
	DUTY A: INSTALLING ELECTRIC APPLIANCES		
AR-01	Installing and wiring an electric range	6	10
AR-02	Installing and wiring a cook top	2	6
AR-03	Installing and wiring an electric oven	2	6
AR-04	Installing and wiring an electric clothes dryer	2	6
AR-05	Installing and wiring an electric water heater	2	6
AR-06	Installing and wiring a microwave oven	2	6
AR-07	Installing and wiring a refrigerator or freezer	2	6
AR-08	Installing an icemaker	2	6
AR-09	Installing and wiring a trash compactor	2	4
AR-10	Installing and wiring a dishwasher	4	16
AR-11	Installing, plumbing and wiring a clothes washer	2	8
		28	80
	Total Quarter I Class and Lab Hours	86	226
	Total Quarter I Instructional Hours	312	

Quarter II

Task	Title	Class Hours	Lab Hours
	MAJOR BLOCK: APPLIANCE INSTALLATION AND REPAIR		
	DUTY B: INSTALLING GAS APPLIANCES		
AR-12	Installing and plumbing a gas range	6	14
AR-13	Installing and plumbing a gas oven	4	16
AR-14	Installing and plumbing a gas clothes dryer	4	16
AR-15	Installing and plumbing a gas water heater	4	16
AR-16	Installing and plumbing a gas space heater	4	16
AR-17	Installing an outdoor gas grill	4	10
AR-18	Installing a gas appliance vent	4	10
		30	98
	DUTY C: REPAIRING ELECTRIC APPLIANCES		
AR-19	Testing electronic circuitry	5	8
AR-20	Testing and replacing surface units and oven heating elements	4	6
AR-21	Testing and replacing surface units and oven temperature control switches and thermostats	4	8
AR-22	Testing and replacing the oven timer	4	8
AR-23	Testing and replacing ceramic cook tops	4	8
AR-24	Troubleshooting microwave ovens	4	8
AR-25	Servicing electric dryer mechanical systems	4	8
AR-26	Servicing electric dryer electrical systems	4	8
AR-27	Testing and replacing electric water heater elements	4	8
AR-28	Testing and replacing electric water heater thermostats	4	8
AR-29	Testing and replacing dishwasher timer and solenoids	5	10
AR-30	Testing and replacing dishwasher level control and door switches	2	8
AR-31	Testing and replacing the dishwasher heating element and thermostat	2	8
AR-32	Testing and replacing the dishwasher automatic dispenser	2	8
AR-33	Testing and replacing the dishwasher drain pump	2	8
AR-34	Testing and replacing the dishwasher motor and relay	2	8
		56	128

Total Quarter II Class and Lab Hours	86		226
Total Quarter II Instructional Hours		312	

Quarter III

Task	Title	Class Hours	Lab Hours
	MAJOR BLOCK: APPLIANCE INSTALLATION AND REPAIR		
	DUTY C: REPAIRING ELECTRIC APPLIANCES (con't)		
AR-35	Testing and replacing the clothes washer timer and solonoids	4	11
AR-36	Testing and replacing the clothes washer water level control and door switches	4	8
AR-37	Checking and replacing the clothes washer agitator	2	2
AR-38	Testing and replacing the clothes washer drain pump	4	11
AR-39	Testing and replacing the clothes washer clutch and transmission	4	12
AR-40	Servicing and replacing the clothes washer motor and relay	4	12
		22	56
	DUTY D: REPAIRING GAS APPLIANCES		
AR-41	Heating and cooking with petroleum gases	8	2
AR-42	Inspecting heat exchangers	4	8
AR-43	Replacing gas orifices	4	8
AR-44	Adjusting pilot lights	4	8
AR-45	Replacing and adjusting main gas burners	4	8
AR-46	Replacing and adjusting gas regulators	4	8
AR-47	Testing, replacing and adjusting combination diaphragm valves	4	8
AR-48	Testing and replacing electromagnetic safety devices	4	8
AR-49	Testing, replacing and adjusting gas oven controls	4	8
AR-50	Testing, replacing and adjusting gas range controls	4	8
AR-51	Testing, replacing and adjusting gas/electric controls	4	8
AR-52	Testing and replacing gas water heater relief valves	4	8
AR-53	Testing and replacing gas water heater thermostats	4	8
AR-54	Testing, replacing and adjusting water heater gas controls	4	8
AR-55	Servicing gas clothes dryer mechanical/electrical systems	4	8
AR-56	Testing, replacing and adjusting dryer gas controls	4	8
AR-57	Testing, replacing and adjusting gas space heater thermostats	4	8

Task	Title	Class Hours	Lab Hours
AR-58	Testing, replacing and adjusting space heater gas controls	4	8
AR-59	Testing, replacing and adjusting outdoor grill gas controls	4	8
AR-60	Testing, replacing and adjusting outdoor grill gas controls	4	4
		84	150
	Total Quarter III Class and Lab Hours	106	206
	Total Quarter III Instructional Hours	312	

Quarter IV

Task	Title	Class Hours	Lab Hours
	MAJOR BLOCK: REFRIGERATION		
	DUTY A: REFRIGERATION FUNDAMENTALS		
RF-01	Demonstrating a knowledge of the basic refrigeration concepts	4	0
RF-02	Describing the function of the basic refrigeration cycle components	2	2
RF-03	Using refrigeration tools	2	4
RF-04	Drilling, tapping and threading	2	10
RF-05	Identifying tubing and pipe fittings	2	6
		12	22
	DUTY B: TUBING AND PIPE		
RF-06	Performing basic copper tubing opertions	2	8
RF-07	Soft soldering copper tubing	2	6
RF-08	Silver brazing	2	4
		6	18
	DUTY C: REFRIGERANTS		
RF-09	Handling refrigerants	2	2
RF-10	Installing and using access valves	5	10
RF-11	Maintaining refrigeration manifold gauges	2	2
RF-12	Installing and using refrigeration manifold gauges	2	4
RF-13	Evacuating a refrigeration system	3	12
RF-14	Installing refrigeration accessories	6	14
RF-15	Testing for leaks	1	3
RF-16	Charging the system	1	3
		22	50
	DUTY D: TROUBLESHOOTING		
RF-17	Testing the compressor	2	4
RF-18	Troubleshooting condensers	2	6
RF-19	Troubleshooting evaporators	2	6
RF-20	Troubleshooting automatic expansion valves	1	3
RF-21	Troubleshooting capillary tubes	1	3
RF-22	Troubleshooting thermostatic expansion valves	2	2
RF-23	Troubleshooting the refrigeration system	2	6
		12	30

Task	Title	Class Hours	Lab Hours
	DUTY E: WINDOW AIR CONDITIONING		
RF-24	Installing a window A/C unit	2	8
RF-25	Performing pre-season start-up maintenance on window A/C units	2	8
RF-26	Troubleshooting compressor burnout in a window A/C	2	8
RF-27	Evacuating and charging window A/C units	2	8
RF-28	Troubleshooting fans and fan motors in window A/C units	2	6
RF-29	Troubleshooting mechanical problems in window A/C refrigeration cycle	2	6
RF-30	Troubleshooting window A/C electrical system	2	6
		14	50
	DUTY F: REFRIGERATORS AND FREEZERS		
RF-31	Identifying and describing the function of the refrigeration components	2	8
RF-32	Evacuating and charging domestic refrigerator and freezer systems	4	12
RF-33	Testing and replacing the refrigeration cycle components	6	14
RF-34	Troubleshooting refrigerator/freezer compressor burnout	2	8
RF-35	Testing and replacing the refrigerator/freezer fans and fan motor	2	8
RF-36	Diagnosing problems in refrigerators and freezers	2	8
		18	58
	Total Quarter IV Class and Lab Hours	84	228
	Total Quarter IV Instructional Hours	312	

SECTION V

RECORDS

SECTION V

Section V Content List

Individualized Competency Record
Group Progress Chart

Section V presents suggested ways of recording and documenting the progress of students through the curriculum. The recommended procedures include options for both individual and group records. The very important function of communicating the student's qualifications to potential employers is handled clearly and efficiently by the use of the Certificate of Competency, which is also described in this section.

RECORDS MANAGEMENT

This guide provides a series of easy to use documents that will aid the instructor in recordkeeping and that will be beneficial to the student in entering the work force.

In addition to providing the instructor with an "at a glance" assessment of individual and/or group progress, a Certificate of Competency, which can be used by students seeking employment, is included.

The group progress chart reflects individual task completion of all students. Due to confidentiality of records, grades must not be recorded on the chart. A notation indicating task completion (i.e., x or check) should be used.

INSTRUCTIONS

Instructions

Competency Checklist

1) Enter the student's name.
2) Enter the date and instructor's initials as each unit of instruction is completed.

The Competency Checklist automatically indicates when all the requirements for each DOT exit point or job title have been completed by the student. At each point on the certificate where an asterisk appears, the student is eligible to receive a Certificate of Competency.

Certificate of Competency

A Certificate of Competency is to be issued for each job title for which a student is qualified.

1) Enter the student's name.
2) Enter the school's name
3) Sign and date the form.

A Certificate of Competency may be issued at the time a student qualifies for it, or all certificates for which a student qualifies may be issued to the student when he/she completes or leaves the program.

Group Progress Chart

1) Enter all program tasks across top of matrix.
2) Enter the students' names down the left hand side of matrix.
3) As each student completes a task, a notation should be made in the square which corresponds with the task and the student's name.

COMPETENCY CHECKLIST

PROGRAM: APPLIANCE REPAIR

STUDENT NAME: ____________________________________

TASK NO.	UNIT COMPETENCIES	DATE	IN'T.	EXIT POINTS JOB TITLE Electrical-Appliance Preparer DOT NO. 827.584-010	Household-Appliance Installer 827.661-010	Electrical-Appliance Servicer 827.261-010	Gas-Appliance Servicer Helper 637.684-010	Gas-Appliance Servicer 637.261-018	A/C Inst.-Servicer Helper, Window Unit 637.687-010	A/C Installer-Servicer, Window Unit 637.261-010	Gas Leak Tester 827.584-014	Refrigeration Mechanic Helper 637.687-014	Refrigerator Tester 827.384-010	Refrigeration Unit Repairer 637.381-014
	Electricity													
EL-01	Identifying safe working conditions			X	X	X	X	X	X	X	X	X	X	X
EL-02	Using basic electrical theory			X	X	X	X	X	X	X	X	X	X	X
EL-03	Computing Ohm's law and power formulas			X	X	X			X	X		X	X	X
EL-04	Using electric meters			X	X	X	X	X	X	X	X	X	X	X
EL-05	Identifying electrical symbols			X	X	X	X	X	X	X	X	X	X	X
EL-06	Drawing basic schematic diagrams			X	X	X	X	X	X	X	X	X	X	X
EL-07	Laying out and wiring series and parallel circuits			X	X	X			X	X		X	X	X
EL-08	Reading and drawing advanced schematic diagrams			X	X	X	X	X	X	X	X	X	X	X
EL-09	Laying out, wiring and testing an alternating current (AC) circuit			X	X	X			X	X		X	X	X
EL-10	Selecting wire size and making connections			X	X	X			X	X		X	X	X
EL-11	Making main panel connections				X	X				X				X
EL-12	Installing and testing shaded pole motors					X				X		X		X
EL-13	Installing and testing split phase motors					X				X		X		X
EL-14	Checking capacitors for serviceability					X				X		X		X
EL-15	Installing and testing permanent split capacitor (PSC) motors					X				X		X		X
EL-16	Installing and testing capacitor start (CS) motors					X				X		X		X
EL-17	Installing and testing capacitor start/run (CSR) motors					X				X		X		X
EL-18	Troubleshooting electric motors					X				X		X		X
EL-19	Servicing electric motors					X				X		X		X
EL-20	Installing 115 volt AC appliance circuits				X	X				X		X		X
EL-21	Installing split switched receptacles				X	X				X		X		X
EL-22	Installing 230 volt AC appliance circuits				X	X				X		X		X
EL-23	Using standard measurements			X	X	X	X	X	X	X	X	X	X	X
EL-24	Identifying and drawing electrical symbols			X	X	X	X	X	X	X	X	X	X	X
	Appliance Installation and Repair													
AR-01	Installing and wiring an electric range			X	X	X								
AR-02	Installing and wiring a cook top			X	X	X								
AR-03	Installing and wiring an electric oven			X	X	X								
AR-04	Installing and wiring an electric clothes dryer			X	X	X								
AR-05	Installing and wiring an electric water heater			X	X	X								
AR-06	Installing and wiring a microwave oven			X	X	X								
AR-07	Installing and wiring a refrigerator or freezer			X	X	X						X	X	X
AR-08	Installing an icemaker			X	X	X								
AR-09	Installing and wiring a trash compactor			X	X	X								
AR-10	Installing and wiring a dishwasher			X	X	X								
AR-11	Installing, plumbing and wiring a clothes washer			*X	X	X								
AR-12	Installing and plumbing a gas range				X		X	X						
AR-13	Installing and plumbing a gas oven				X		X	X						
AR-14	Installing and plumbing a gas clothes dryer				X		X	X						
AR-15	Installing and plumbing a gas water heater				X		X	X						
AR-16	Installing and plumbing a gas space heater				X		X	X						
AR-17	Installing an outdoor gas grill				X		X	X						
AR-18	Installing a gas appliance vent				X		X	X						
AR-19	Testing electronic circuitry				*X		X					X		
AR-20	Testing and replacing surface units and oven heating elements					X								
AR-21	Testing and replacing surface units and oven temperature control switches and thermostats					X								
AR-22	Testing and replacing the oven timer					X								
AR-23	Testing and replacing ceramic cook tops					X								
AR-24	Troubleshooting microwave ovens					X								
AR-25	Servicing electric dryer mechanical systems					X								
AR-26	Servicing electric dryer electrical systems					X								
AR-27	Testing and replacing electric water heater elements					X								
AR-28	Testing and replacing electric water heater thermostats					X								

COMPETENCY CHECKLIST

PROGRAM: APPLIANCE REPAIR

STUDENT NAME:____________________________________

EXIT POINTS

TASK NO.	UNIT COMPETENCIES	DATE	IN'T.	JOB TITLE Electrical-Appliance Preparer DOT NO. 827.584-010	Household-Appliance Installer 827.661-010	Electrical-Appliance Servicer 827.261-010	Gas-Appliance Servicer Helper 637.684-010	Gas-Appliance Servicer 637.261-018	A/C Inst.-Servicer Helper, Window Unit 637.687-010	A/C Installer-Servicer, Window Unit 637.261-010	Gas Leak Tester 827.584-014	Refrigeration Mechanic Helper 637.687-014	Refrigerator Tester 827.384-010	Refrigeration Unit Repairer 637.381-014
AR-29	Testing and replacing dishwasher timer and solenoids					X								
AR-30	Testing and replacing dishwasher level control and door switches					X								
AR-31	Testing and replacing the dishwasher heating element and thermostat					X								
AR-32	Testing and replacing the dishwasher automatic dispenser					X								
AR-33	Testing and replacing the dishwasher drain pump					X								
AR-34	Testing and replacing the dishwasher motor and relay					X								
AR-35	Testing and replacing the clothes washer timer and solenoids					X								
AR-36	Testing and replacing the clothes washer water level control and door switches					X								
AR-37	Checking and replacing the clothes washer agitator					X								
AR-38	Testing and repairing the clothes washer drain pump					X								
AR-39	Testing and replacing the clothes washer clutch and transmission					X								
AR-40	Servicing and replacing the clothes washer motor and relay					X								
AR-41	Heating and cooking with petroleum gases						X	X						
AR-42	Inspecting heat exchangers						X	X						
AR-43	Replacing gas orifices						X	X						
AR-44	Adjusting pilot lights						*X	X						
AR-45	Replacing and adjusting main gas burners							X						
AR-46	Replacing and adjusting gas regulators							X						
AR-47	Testing, replacing and adjusting combination diaphragm valves							X						
AR-48	Testing and replacing electromagnetic safety devices							X						
AR-49	Testing, replacing and adjusting gas oven controls							X						
AR-50	Testing, replacing and adjusting gas range controls							X						
AR-51	Testing, replacing and adjusting gas/electric controls							X						
AR-52	Testing and replacing gas water heater relief valves							X						
AR-53	Testing and replacing gas water heater thermostats							X						
AR-54	Testing, replacing and adjusting water heater gas controls							X						
AR-55	Servicing gas clothes dryer mechanical/electrical systems							X						
AR-56	Testing, replacing and adjusting dryer gas controls							X						
AR-57	Testing, replacing and adjusting gas space heater thermostats							X						
AR-58	Testing, replacing and adjusting space heater fan and controls							X						
AR-59	Testing, replacing and adjusting space heater gas controls							X						
AR-60	Testing, replacing and adjusting outdoor grill gas controls							*X						
	Refrigeration													
RF-01	Demonstrating a knowledge of the basic refrigeration concepts								X	X	X	X	X	X
RF-02	Describing the function of the basic refrigeration cycle components								X	X	X	X	X	X
RF-03	Using refrigeration tools								X	X	X	X	X	X
RF-04	Drilling, tapping and threading								X	X	X	X	X	X
RF-05	Identifying tubing and pipe fittings								X	X	X	X	X	X
RF-06	Performing basic copper tubing operations								X	X	X	X	X	X

COMPETENCY CHECKLIST

PROGRAM: APPLIANCE REPAIR

STUDENT NAME:____________________________________

				EXIT POINTS										
TASK NO.	UNIT COMPETENCIES	DATE	IN'T.	DOT NO. 827.584-010 JOB TITLE Electrical-Appliance Preparer	827.661-010 Household-Appliance Installer	827.261-010 Electrical-Appliance Servicer	637.684-010 Gas-Appliance Servicer Helper	637.261-018 Gas-Appliance Servicer	637.687-010 A/C Inst.-Servicer Helper, Window Unit	637.261-010 A/C Installer-Servicer, Window Unit	827.584-014 Gas Leak Tester	637.687-014 Refrigeration Mechanic Helper	827.384-010 Refrigerator Tester	637.381-014 Refrigeration Unit Repairer
RF-07	Soft soldering copper tubing								X	X	X	X	X	X
RF-08	Silver brazing								X	X	X	X	X	X
RF-09	Handling refrigerants								X	X	X	X	X	X
RF-10	Installing and using access valves								X	X	X	X	X	X
RF-11	Maintaining refrigeration manifold gauges								X	X	X	X	X	X
RF-12	Installing and using refrigeration manifold gauges								X	X	X	X	X	X
RF-13	Evacuating a refrigeration system									X			X	X
RF-14	Installing refrigeration accessories									X			X	X
RF-15	Testing for leaks								X	X	X	X	X	X
RF-16	Charging the system									X			X	X
RF-17	Testing the compressor									X			X	X
RF-18	Troubleshooting condensers									X			X	X
RF-19	Troubleshooting evaporators									X			X	X
RF-20	Troubleshooting automatic expansion valves									X			X	X
RF-21	Troubleshooting capillary tubes									X			X	X
RF-22	Troubleshooting thermostatic expansion valves									X			X	X
RF-23	Troubleshooting the refrigeration system									X	X		X	X
RF-24	Installing a window A/C unit								X	X				
RF-25	Performing pre-season start-up maintenance on window A/C units								*X	X				
RF-26	Troubleshooting compressor burnout in a window A/C									X				X
RF-27	Evacuating and charging window A/C units									X				X
RF-28	Troubleshooting fans and fan motors in window A/C units									X				X
RF-29	Troubleshooting mechanical problems in window A/C refrigeration cycle									X				X
RF-30	Troubleshooting window A/C electrical system									*X				X
RF-31	Identifying and describing the function of the refrigeration components					X					*X	*X	X	X
RF-32	Evacuating and charging domestic refrigerator and freezer systems					X							X	X
RF-33	Testing and replacing the refrigeration cycle components					X							X	X
RF-34	Troubleshooting refrigerator/freezer compressor burnout					X							*X	X
RF-35	Testing and replacing the refrigerator/freezer fans and fan motor					X								X
RF-36	Diagnosing problems in refrigerators and freezers					*X								*X

This is to certify that the above named student has demonstrated proficiency in the performance of the competencies and/or tasks indicated above. These competencies and/or tasks have been determined to be the skills and knowledge that are necessary for entry level employment into the job classifications indicated.

Date______________ Instructor____________________________

School____________________________

Instructor____________________________

Instructor____________________________

Instructor____________________________

*Certificate of Competency can be issued

CERTIFICATE OF COMPETENCY

This is to Certify that

Jennifer Michelle Moye

of

[illegible] Tech

SAMPLE

has successfully mastered the competencies required to perform the job of

ELECTRICAL-APPLIANCE PREPARER

Lee Morris

May 9, 1980

The student named on this certificate has demonstrated mastery of the following unit level competencies required to perform the job of Electrical-Appliance Preparer.

ELECTRICAL-APPLIANCE PREPARER

(D.O.T. Code 827.584-010)

Fundamentals

Identifying safe working conditions
Using basic electrical theory
Computing Ohm's law and power formulas
Using electric meters
Identifying electrical symbols
Drawing basic schematic diagrams
Laying out and wiring series and parallel circuits
Reading and drawing advanced schematic diagrams
Laying out, wiring and testing an alternating current (AC) circuit
Selecting wire size and making connections
Making main panel connections

Blueprint Reading

Using standard measurements
Identifying and drawing electrical symbols

Installing Electrical Appliances

Installing and wiring an electric range
Installing and wiring a cook top
Installing and wiring an electric oven
Installing and wiring an electric clothes dryer
Installing and wiring an electric water heater
Installing and wiring a microwave oven
Installing and wiring a refrigerator or freezer
Installing an icemaker
Installing and wiring a trashcompactor
Installing and wiring a dishwasher
Installing, plumbing and wiring a clothes washer

CERTIFICATE OF COMPETENCY

This is to Certify that

____

of

____

has successfully mastered the competencies required to perform the job of

ELECTRICAL-APPLIANCE PREPARER

____

____

V-13

The student named on this certificate has demonstrated mastery of the following unit level competencies required to perform the job of Electrical-Appliance Preparer.

ELECTRICAL-APPLIANCE PREPARER
(D.O.T. Code 827.584-010)

Fundamentals

Identifying safe working conditions
Using basic electrical theory
Computing Ohm's law and power formulas
Using electric meters
Identifying electrical symbols
Drawing basic schematic diagrams
Laying out and wiring series and parallel circuits
Reading and drawing advanced schematic diagrams
Laying out, wiring and testing an alternating current (AC) circuit
Selecting wire size and making connections
Making main panel connections

Blueprint Reading

Using standard measurements
Identifying and drawing electrical symbols

Installing Electrical Appliances

Installing and wiring an electric range
Installing and wiring a cook top
Installing and wiring an electric oven
Installing and wiring an electric clothes dryer
Installing and wiring an electric water heater
Installing and wiring a microwave oven
Installing and wiring a refrigerator or freezer
Installing an icemaker
Installing and wiring a trashcompactor
Installing and wiring a dishwasher
Installing, plumbing and wiring a clothes washer

CERTIFICATE OF COMPETENCY

This is to Certify that

____

of

____

has successfully mastered the competencies required to perform the job of

HOUSEHOLD-APPLIANCE INSTALLER
____

____

____

The student named on this certificate has demonstrated mastery of the following unit level competencies required to perform the job of Household Appliance Installer.

HOUSEHOLD-APPLIANCE INSTALLER
(D.O.T. Code 827.661-010)

Fundamentals
Identifying safe working conditions
Using basic electrical theory
Computing Ohm's law and power formulas
Using electric meters
Identifying electrical symbols
Drawing basic schematic diagrams
Laying out and wiring series and parallel circuits
Reading and drawing advanced schematic diagrams
Laying out, wiring and testing an alternating current (AC) circuit
Selecting wire size and making connections
Making main panel connections

Appliance Residential Wiring
Installing 115 volt AC appliance circuits
Installing split switched receptacles
Installing 230 volt AC appliance circuits

Blueprint Reading
Using standard measurements
Identifying and drawing electrical symbols

Installing Electric Appliances
Installing and wiring an electric range
Installing and wiring a cook top
Installing and wiring an electric oven
Installing and wiring an electric clothes dryer
Installing and wiring an electric water heater
Installing and wiring a microwave oven
Installing and wiring a refrigerator or freezer
Installing an icemaker
Installing and wiring a trashcompactor
Installing and wiring a dishwasher
Installing, plumbing and wiring a clothes washer

Install Gas Appliances
Installing and plumbing a gas range
Installing and plumbing a gas oven
Installing and plumbing a gas clothes dryer
Installing and plumbing a gas water heater
Installing and plumbing a gas space heater
Installing an outdoor gas grill
Installing a gas appliance vent

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CERTIFICATE OF COMPETENCY

This is to Certify that

of

has successfully mastered the competencies required to perform the job of

ELECTRICAL-APPLIANCE SERVICER

The student named on this certificate has demonstrated mastery of the following unit level competencies required to perform the job of Electrical-Appliance Servicer.

ELECTRICAL-APPLIANCE SERVICER

(D.O.T. Code 827.261-010)

Fundamentals

- Identifying safe working conditions
- Using basic electrical theory
- Computing Ohm's law and power formulas
- Using electric meters
- Identifying electrical symbols
- Drawing basic schematic diagrams
- Laying out and wiring series and parallel circuits
- Reading and drawing advanced schematic diagrams
- Laying out, wiring and testing an alternating current (AC) circuit
- Selecting wire size and making connections
- Making main panel connections

Electric Motors

- Installing and testing shaded pole motors
- Installing and testing split phase motors
- Checking capacitors for servicability
- Installing and testing permanent split capacitor (PSC) motors
- Installing and testing capacitor start (CS) motors
- Installing and testing capacitor start/run (CSR) motors
- Troubleshooting electric motors
- Servicing electric motors

Appliance Residential Wiring

- Installing 115 volt AC appliance circuits
- Installing split switched receptacles
- Installing 230 volt AC appliance circuits

Blueprint Reading

- Using standard measurements
- Identifying and drawing electrical symbols

Installing Electric Appliances

- Installing and wiring an electric range
- Installing and wiring a cook top
- Installing and wiring an electric oven
- Installing and wiring an electric clothes dryer
- Installing and wiring an electric water heater
- Installing and wiring a microwave oven
- Installing and wiring a refrigerator or freezer
- Installing an icemaker
- Installing and wiring a trashcompactor
- Installing and wiring a dishwasher
- Installing, plumbing and wiring a clothes dryer

Repairing Electric Appliances

- Testing electronic circuitry
- Testing and replacing surface units and oven heating elements
- Testing and replacing surface units and oven temperature control switches and thermostats
- Testing and replacing the oven timer
- Testing and replacing ceramic cook tops
- Troubleshooting microwave ovens
- Servicing electric dryer mechanical systems
- Servicing electric dryer electrical systems
- Testing and replacing electric water heater elements
- Testing and replacing electric water heater thermostats
- Testing and replacing dishwasher timer and solenoids
- Testing and replacing dishwasher level control and door switches
- Testing and replacing the dishwasher heating element and thermostat
- Testing and replacing the dishwasher automatic dispenser
- Testing and replacing the dishwasher drain pump
- Testing and replacing the dishwasher motor and relay
- Testing and replacing the clothes washer timer and solenoids
- Testing and replacing the clothes washer water level control and door switches
- Checking and replacing the clothes washer agitator
- Testing and repairing the clothes washer drain pump
- Testing and replacing the clothes washer clutch and transmission
- Servicing and replacing the clothes washer motor and relay

Refrigerators and Freezers

- Identifying and describing the function of the refrigeration components
- Evacuating and charging domestic refrigerator and freezer systems
- Testing and replacing the refrigeration cycle components
- Troubleshooting refrigerator/freezer compressor burnout
- Testing and replacing the refrigerator/freezer fans and fan motor
- Diagnosing problems in refrigerators and freezers

CERTIFICATE OF COMPETENCY

This is to Certify that

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of

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has successfully mastered the competencies required to perform the job of

GAS-APPLIANCE SERVICER HELPER

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The student named on this certificate has demonstrated mastery of the following unit level competencies required to perform the job of Gas-Appliance Servicer Helper.

GAS-APPLIANCE SERVICER HELPER
(D.O.T. Code 637.684-010)

Fundamentals
Identifying safe working conditions
Using basic electrical theory
Computing Ohm's law and power formulas
Using electric meters
Identifying electrical symbols
Drawing basic schematic diagrams
Reading and drawing advanced schematic diagrams

Blueprint Reading
Using standard measurements
Identifying and drawing electrical symbols

Installing Gas Appliances
Installing and plumbing a gas range
Installing and plumbing a gas oven
Installing and plumbing a gas clothes dryer
Installing and plumbing a gas water heater
Installing and plumbing a gas space heater
Installing an outdoor gas grill
Installing a gas appliance vent

Repairing Gas Appliances
Heating and cooking with petroleum gases
Inspecting heat exchangers
Replacing gas orifices
Adjusting pilot lights

CERTIFICATE OF COMPETENCY

This is to Certify that

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of

____

has successfully mastered the competencies required to perform the job of

GAS-APPLIANCE SERVICER

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The student named on this certificate has demonstrated mastery of the following unit level competencies required to perform the job of Gas-Appliance Servicer.

GAS-APPLIANCE SERVICER
(D.O.T. Code 637.261-010)

Fundamentals
Identifying safe working conditions
Using basic electrical theory
Using electric meters
Identifying electrical symbols
Drawing basic schematic diagrams
Reading and drawing advanced schematic diagrams

Blueprint Reading
Using standard measurements
Identifying and drawing electrical symbols

Installing Gas Appliances
Installing and plumbing a gas range
Installing and plumbing a gas oven
Installing and plumbing a gas clothes dryer
Installing and plumbing a gas water heater
Installing and plumbing a gas space heater
Installing an outdoor gas grill
Installing a gas appliance vent

Repairing Electric Appliances
Testing electronic circuitry

Repairing Gas Appliances
Heating and cooking with petroleum gases
Inspecting heat exchangers
Replacing gas orifices
Adjusting pilot lights
Replacing and adjusting main gas burners
Replacing and adjusting gas regulators
Testing, replacing and adjusting combination diaphragm valves
Testing and replacing electromagnetic safety devices
Testing, replacing and adjusting gas oven controls
Testing, replacing and adjusting gas range controls
Testing, replacing and adjusting gas/electric controls
Testing and replacing gas water heater relief valves
Testing and replacing gas water heater thermostats
Testing, replacing and adjusting water heater gas controls
Servicing gas clothes dryer mechanical/electrical systems
Testing, replacing and adjusting dryer gas controls
Testing, replacing and adjusting gas space heater thermostats
Testing, replacing and adjusting space heater fan and controls
Testing, replacing and adjusting space heater gas controls
Testing, replacing and adjusting outdoor grill gas controls

CERTIFICATE OF COMPETENCY

This is to Certify that

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of

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has successfully mastered the competencies required to perform the job of

A/C INST.-SERVICER HELPER, WINDOW UNIT

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The student named on this certificate has demonstrated mastery of the following unit level competencies required to perform the job of A/C Inst.-Servicer Helper, Window Unit.

A/C Inst.-Servicer Helper, Window Unit
(D.O.T. Code 637.687-010)

Fundamentals
Identifying safe working conditions
Using basic electrical theory
Computing Ohm's law and power formulas
Using electric meters
Identifying electrical symbols
Drawing basic schematic diagrams
Laying out and wiring series and parallel circuits
Reading and drawing advanced schematic diagrams
Laying out, wiring and testing an alternating current (AC) circuit
Selecting wire size and making connections

Blueprint Reading
Using standard measurements
Identifying and drawing electrical symbols

Refrigeration Fundamentals
Demonstrating a knowledge of the basic refrigeration concepts
Describing the function of the basic refrigeration cycle components
Using refrigeration tools
Drilling, tapping and threading
Identifying tubing and pipe fittings

Tubing and Pipe
Performing basic copper tubing operations
Soft soldering copper tubing
Silver brazing

Refrigerants
Handling refrigerants
Installing and using access valves
Maintaining refrigeration manifold gauges
Installing and using refrigeration manifold gauges
Testing for leaks

Window Air Conditioning
Installing a window A/C unit
Performing pre-season start-up maintenance on window A/C units

CERTIFICATE OF COMPETENCY

This is to Certify that

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of

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has successfully mastered the competencies required to perform the job of

A/C INSTALLER-SERVICER WINDOW UNIT

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The student named on this certificate has demonstrated mastery of the following unit level competencies required to perform the job of A/C Installer-Servicer Window Unit.

A/C INSTALLER-SERVICER WINDOW UNIT
(D.O.T. Code 637.261-010)

Fundamentals
Identifying safe working conditions
Using basic electrical theory
Computing Ohm's law and power formulas
Using electric meters
Identifying electrical symbols
Drawing basic schematic diagrams
Laying out and wiring series and parallel circuits
Reading and drawing advanced schematic diagrams
Laying out, wiring and testing an alternating current (AC) circuit
Selecting wire size and making connections
Making main panel connections

Electric Motors
Installing and testing shaded pole motors
Installing and testing split phase motors
Checking capacitors for servicability
Installing and testing permanent split capacitor (PSC) motors
Installing and testing capacitor start (CS) motors
Installing and testing capacitor start/run (CSR) motors
Troubleshooting electric motors

Appliance Residential Wiring
Installing 115 volt AC appliance circuits
Installing split switched receptacles
Installing 230 volt AC appliance circuits

Blueprint Reading
Using standard measurements
Identifying and drawing electrical symbols

Refrigeration Fundamentals
Demonstrating a knowledge of the basic refrigeration concepts
Describing the function of the basic refrigeration cycle components
Using refrigeration tools
Drilling, tapping and threading
Identifying tubing and pipe fittings

Tubing and Pipe
Performing basic copper tubing operations
Soft soldering copper tubing
Silver brazing

Refrigerants
Handling refrigerants
Installing and using access valves
Maintaining refrigeration manifold gauges
Installing and using refrigeration manifold gauges
Evacuating a refrigeration system
Installing refrigeration accessories
Testing for leaks
Charging the system

Troubleshooting
Testing the compressor
Troubleshooting condensers
Troubleshooting evaporators
Troubleshooting automatic expansion valves
Troubleshooting capillary tubes
Troubleshooting thermostatic expansion valves
Troubleshooting the refrigeration system

Window Air Conditioning
Installing a window A/C unit
Performing pre-season start-up maintenance on window A/C units
Troubleshooting compressor burn out in a window A/C
Evacuating and charging window A/C units
Troubleshooting fans and fan motors in window A/C units
Troubleshooting mechanical problems in window A/C refrigeration cycle
Troubleshooting window A/C electrical system

CERTIFICATE OF COMPETENCY

This is to Certify that

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of

____

has successfully mastered the competencies required to perform the job of

GAS LEAK TESTER

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The student named on this certificate has demonstrated mastery of the following unit level competencies required to perform the job of Gas Leak Tester.

GAS LEAK TESTER
(D.O.T. Code 827.584-014)

Fundamentals
- Identifying safe working conditions
- Using basic electrical theory
- Using electric meters
- Identifying electrical symbols
- Drawing basic schematic diagrams
- Laying out and wiring series and parallel circuits
- Reading and drawing advanced schematic diagrams

Blueprint Reading
- Using standard measurements
- Identifying and drawing electrical symbols

Refrigeration Fundamentals
- Demonstrating a knowledge of the basic refrigeration concepts
- Describing the function of the basic refrigeration cycle components
- Using refrigeration tools
- Drilling, tapping and threading
- Identifying tubing and pipe fittings

Tubing and Piping
- Performing basic copper tubing operations
- Soft soldering copper tubing
- Silver brazing

Refrigerants
- Handling refrigerants
- Installing and using access valves
- Maintaining refrigeration manifold gauges
- Installing and using refrigeration manifold gauges
- Testing for leaks

Troubleshooting
- Troubleshooting the refrigeration system

Refrigerators and Freezers
- Identifying and describing the function of the refrigeration components

CERTIFICATE OF COMPETENCY

This is to Certify that

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of

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has successfully mastered the competencies required to perform the job of

REFRIGERATION MECHANIC HELPER

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The student named on this certificate has demonstrated mastery of the following unit level competencies required to perform the job of Refrigeration Mechanic Helper.

REFRIGERATION MECHANIC HELPER
(D.O.T. Code 637.687-014)

Fundamentals
Identifying safe working conditions
Using basic electrical theory
Computing Ohm's law and power formulas
Using electric meters
Identifying electrical symbols
Drawing basic schematic diagrams
Laying out and wiring series and parallel circuits
Reading and drawing advanced schematic diagrams
Laying out, wiring and testing an alternating current (AC) circuit
Selecting wire size and making connections

Electric Motors
Installing and testing shaded pole motors
Installing and testing split phase motors
Checking capacitors for servicability
Installing and testing permanent split capacitor (PSC) motors
Installing and testing capacitor start (CS) motors
Installing and testing capacitor start/run (CSR) motors
Troubleshooting electric motors

Appliance Residential Wiring
Installing 115 volt AC appliance circuits
Installing split switched receptacles
Installing 230 volt AC appliance circuits

Blueprint Reading
Using standard measurements
Identifying and drawing electrical symbols

Installing Electric Appliances
Installing and wiring a refrigerator or freezer

Refrigeration Fundamentals
Demonstrating a knowledge of the basic refrigeration concepts
Describing the function of the basic refrigeration cycle components
Using refrigeration tools
Drilling, tapping and threading
Identifying tubing and pipe fittings

Tubing and Piping
Performing basic copper tubing operations
Soft soldering copper tubing
Silver brazing

Refrigerants
Handling refrigerants
Maintaining refrigeration manifold gauges
Installing and using refrigeration manifold gauges
Testing for leaks

Refrigerators and Freezers
Identifying and describing the function of the refrigeration components

CERTIFICATE OF COMPETENCY

This is to Certify that

of

has successfully mastered the competencies required to perform the job of

REFRIGERATOR TESTER

The student named on this certificate has demonstrated mastery of the following unit level competencies required to perform the job of Refrigerator Tester.

REFRIGERATOR TESTER
(D.O.T. Code 827.384-010)

Fundamentals
Identifying safe working conditions
Using basic electrical theory
Computing Ohm's law and power formulas
Using electric meters
Identifying electrical symbols
Drawing basic schematic diagrams
Laying out and wiring series and parallel circuits
Reading and drawing advanced schematic diagrams
Laying out, wiring and testing an alternating current (AC) circuit
Selecting wire size and making connections

Blueprint Reading
Using standard measurements
Identifying and drawing electrical symbols symbols

Installing Electric Appliances
Installing and wiring a refrigerator or freezer

Repairing Electric Appliances
Testing electronic circuitry

Refrigeration Fundamentals
Demonstrating a knowledge of the basic refrigeration concepts
Describing the function of the basic refrigeration cycle components
Using refrigeration tools
Drilling, tapping and threading
Identifying tubing and pipe fittings

Tubing and Piping
Performing basic copper tubing operations
Soft soldering copper tubing
Silver brazing

Refrigerants
Handling refrigerants
Installing and using access valves
Maintaining refrigeration manifold gauges
Installing and using refrigeration manifold gauges
Evacuating a refrigeration system
Installing refrigeration accessories
Testing for leaks
Charging the system

Troubleshooting
Testing the compressor
Troubleshooting condensers
Troubleshooting evaporators
Troubleshooting automatic expansion valves
Troubleshooting capillary tubes
Troubleshooting thermostatic expansion valves
Troubleshooting the refrigeration system

Refrigerators and Freezers
Identifying and describing the function of the refrigeration components
Evacuating and charging domestic refrigerator and freezer systems
Testing and replacing the refrigeration cycle components
Troubleshooting refrigerator/freezer compressor burnout

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CERTIFICATE OF COMPETENCY

This is to Certify that

of

has successfully mastered the competencies required to perform the job of

REFRIGERATION UNIT REPAIRER

The student named on this certificate has demonstrated mastery of the following unit level competencies required to perform the job of Refrigeration Unit Repairer.

REFRIGERATION UNIT REPAIRER
(D.O.T. Code 637.381-014)

Fundamentals
Identifying safe working conditions
Using basic electrical theory
Computing Ohm's law and power formulas
Using electric meters
Identifying electrical symbols
Drawing basic schematic diagrams
Laying out and wiring series and aprallel circuits
Reading and drawing advanced schematic diagrams
Laying out, wiring and testing an alternating current (AC) circuit
Selecting wire size and making connections
Making main panel connections

Electric Motors
Installing and testing shaded pole motors
Installing and testing split phase motors
Checking capacitors for servicability
Installing and testing permanent split capacitor (PSC) motors
Installing and testing capacitor start (CS) motors
Installing and testing capacitor start/run (CSR) motors
Troubleshooting electric motors

Appliance Residential Wiring
Installing 115 volt AC appliance circuits
Installing split switched receptacles
Installing 230 volt AC appliance circuits

Blueprint Reading
Using standard measurements
Identifying and drawing electrical symbols

Installing Electric Appliances
Installing and wiring a refrigerator or freezer

Refrigeration Fundamentals
Demonstrating a knowledge of the basic refrigeration concepts
Describing the function of the basic refrigeration cycle components
Using refrigeration tools
Drilling, tapping and threading
Identifying tubing and pipe fittings

Tubing and Piping
Performing basic copper tubing operations
Soft soldering copper tubing
Silver brazing

Refrigerants
Handling refrigerants
Installing and using access valves
Maintaining refrigeration manifold gauges
Installing and using refrigeration manifold gauges
Evacuating a refrigeration system
Installing refrigeration accessories
Testing for leaks
Charging the system

Troubleshooting
Testing the compressor
Troubleshooting condensers
Troubleshooting evaporators
Troubleshooting automatic expansion valves
Troubleshooting capillary tubes
Troubleshooting thermostatic expansion valves
Troubleshooting the refrigeration system

Window Air Conditioning
Troubleshooting compressor burn out in a window A/C
Evacuating and charging window A/C units
Troubleshooting fans and fan motors in window A/C units
Troubleshooting mechanical problems in window A/C refrigeration cycle
Troubleshooting window A/C electrical system

Refrigerators and Freezers
Identifying and describing the function of the refrigeration components
Evacuating and charging domestic refrigerator and freezer systems
Testing and replacing the refrigeration cycle components
Troubleshooting refrigerator/freezer compressor burnout
Testing and replacing the refrigerator/freezer fans and fan motor
Diagnosing problems in refrigerators and freezers

GROUP PROGRESS CHART

NAME	UNITS/TASKS																				

SECTION VI

FACILITIES

SECTION VI

Section VI Content List

Group Instruction Facilities
Individualized Instruction Facilities

The facility layouts on the following pages are presented to aid in arranging the classroom and laboratory for efficient instruction. The school administration and program instructor must determine an arrangement that best fits the needs of the students by determining the most efficient use of resources available to them not only in the laboratory, but also in the Learning Resource Center settings.

FACILITY LAYOUTS

The layouts on the following pages illustrate how facilities for group and individualized instructional programs may be planned and set up.

Each instructional approach has two important physical areas. These are (1) the laboratory (work) area and classroom for group instruction and (2) the laboratory (work) area and learning resource center (LRC) for individualized instruction.

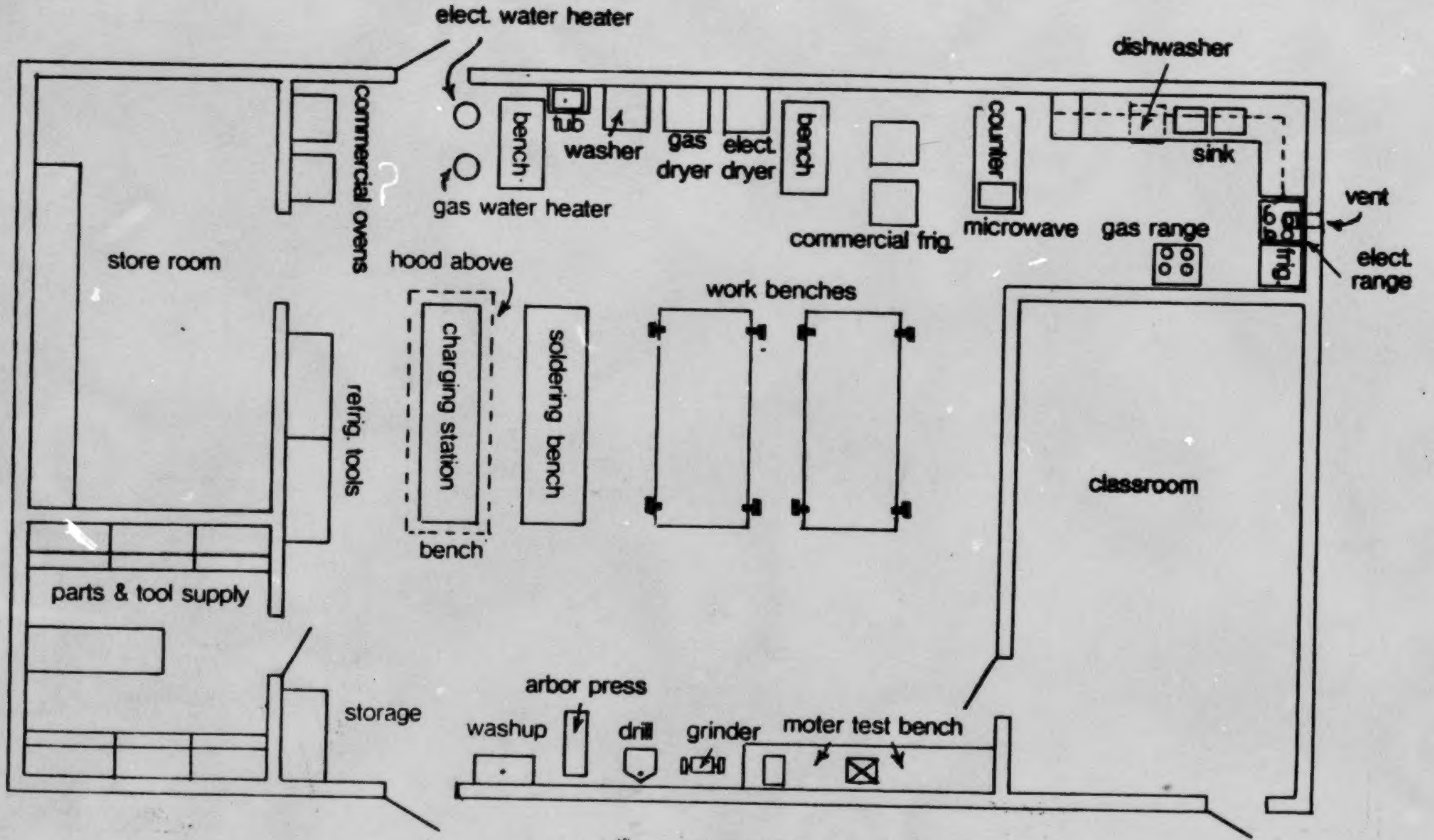
The instructional setting for group instruction is based on that of a traditional classroom. This approach is easily set up and includes little or no modifications. The primary modes of learning are instructor lectures, occasional use of audiovisual aids and student participation. Ideally, all students progress at the same pace.

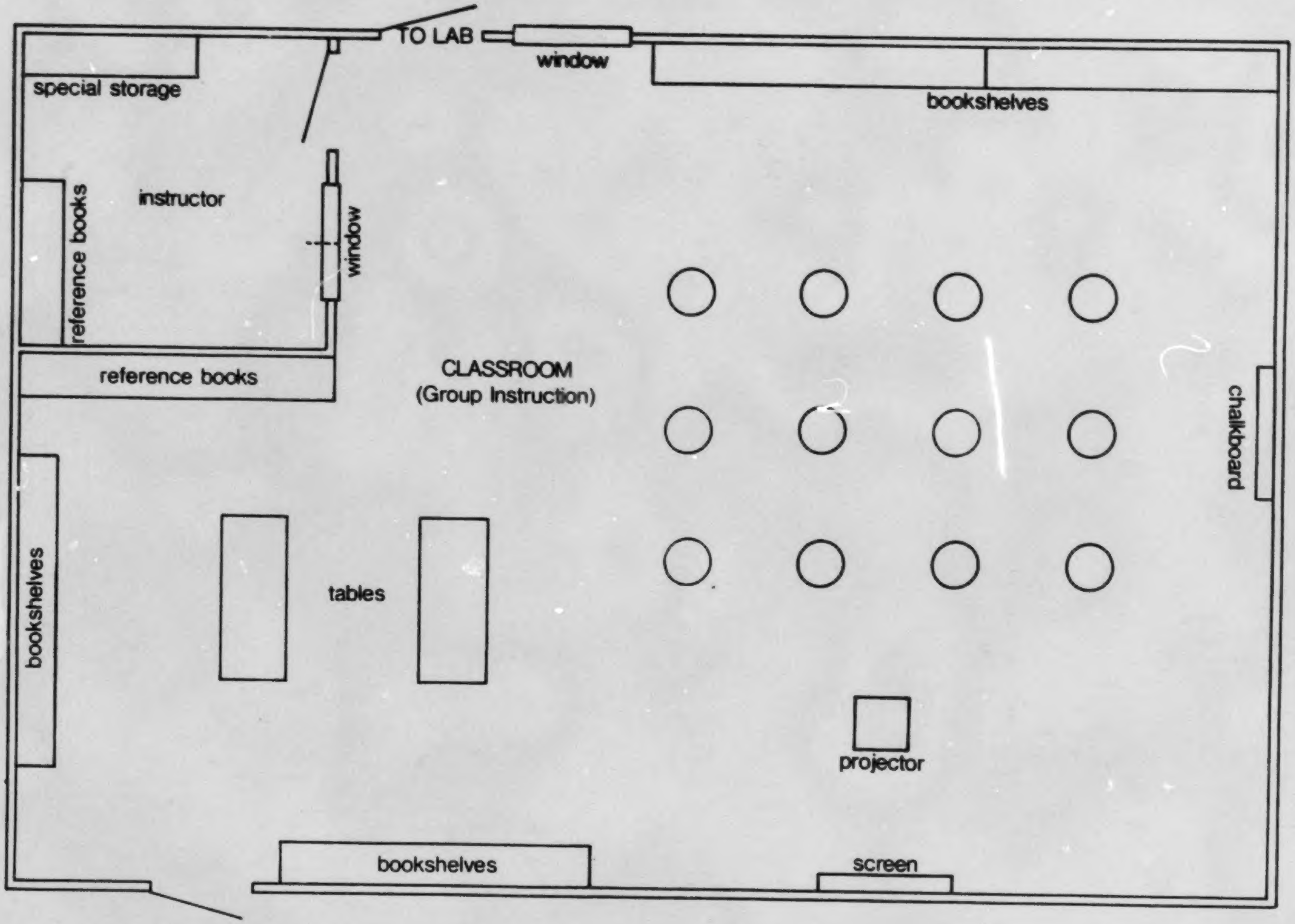
The instructional setting for individual instruction is designed to facilitate a student self-paced progression of learning. The LRC requires careful planning in utilizing available space. When planning to install an individual instruction program in an area not originally designed for this approach, the instructional setting may need modifications. Desks may be replaced with study carrels to allow students to simultaneously participate in a variety of learning activities. A group session area for small group gatherings should also be included. Because the instructor and students rarely meet together as a group, a bulletin board becomes a vital communication device in an LRC. It can be used to post announcements and such instructional information as group progress charts, assignments, positions available in the industry and safety rules.

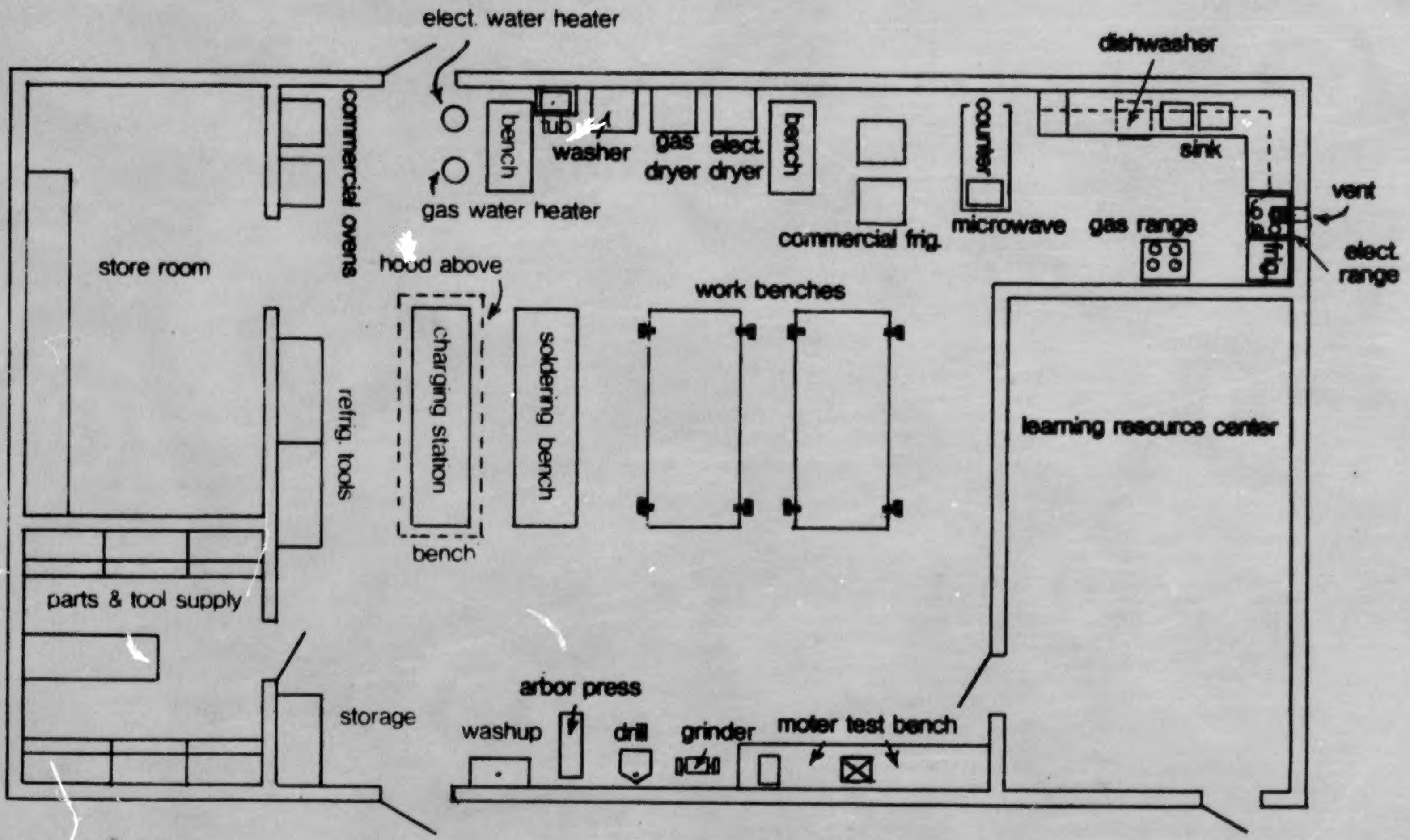
A variety of references, resources and media equipment should be made available to the student. Therefore, an adequate amount of storage area should be included in planning the LRC. Every specific school and department has unique physical layout characteristics and problems. Through innovation, these features may be transformed into LRC advantages rather than disadvantages.

The manner in which the laboratory (work) area is planned and set up need not be affected by the type of instructional approach used by an instructor; it could/will be the same. Some major concerns in the laboratory are: 1) the instructor must always have a clear line of sight to each and every workstation, 2) tools must be accessible to students, but under the control of the instructor and 3) all supplies and materials required for the day's activities must be on hand and ready to use.

The laboratory (work) area facility suggested here has been intentionally left spacious to accommodate the instructor in demonstrations and student practice of tasks such as pacing, target use, using the transit and level rod, setting points on line, etc.

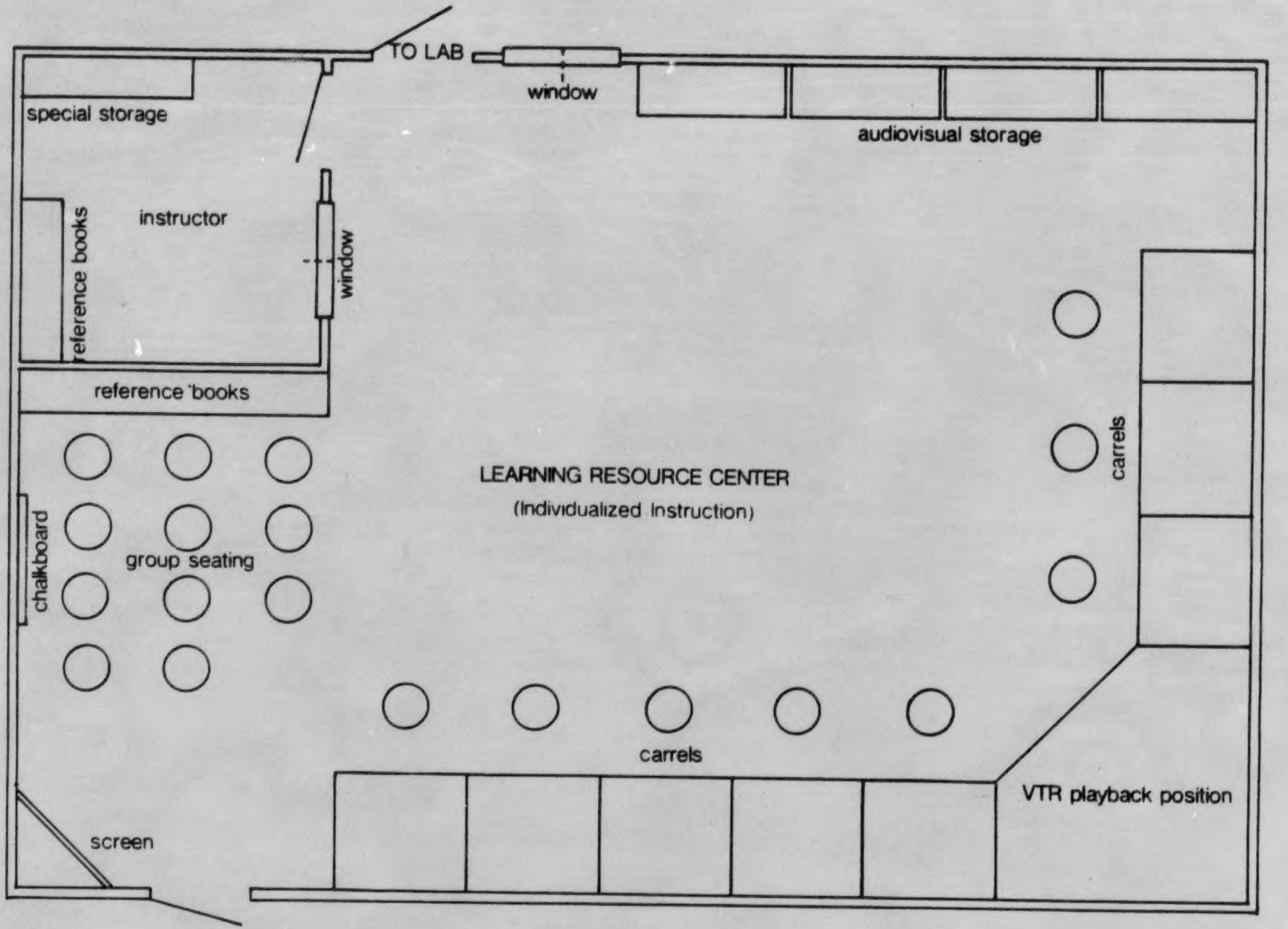

elect. water heater
dishwasher
commercial ovens
bench
tub
washer
gas dryer
elect. dryer
bench
counter
sink
gas water heater
commercial frig.
microwave
gas range
vent
frig.
elect. range
store room
hood above
work benches
charging station
soldering bench
refrig. tools
classroom
bench
parts & tool supply
storage
arbor press
washup
drill
grinder
moter test bench


TO LAB
window
special storage
bookshelves
instructor
reference books
window
reference books
CLASSROOM
(Group Instruction)
chalkboard
bookshelves
tables
projector
bookshelves
screen


elect. water heater
dishwasher
commercial ovens
bench
tub
washer
gas dryer
elect. dryer
bench
counter
sink
gas water heater
vent
commercial frig.
microwave
gas range
frig.
elect. range
store room
hood above
work benches
charging station
soldering bench
refrig. tools
learning resource center
bench
parts & tool supply
storage
arbor press
washup
drill
grinder
moter test bench

408

409


TO LAB
window
special storage
audiovisual storage
instructor
reference books
window
reference books
LEARNING RESOURCE CENTER
(Individualized Instruction)
carrels
chalkboard
group seating
carrels
VTR playback position
screen

APPENDIX A

Resources

RESOURCES

This appendix contains the instructional resource matrix, unit guide reference and additional instructional materials.

The instructional resource matrix lists the audiovisuals, textbooks and student manuals for each task referenced on the unit guide sheets. The audiovisual format is identified by the symbols such as: filmstrip (FS), slide/script (SS), slide/tape (ST), 16mm movie film (MF), transparency (TR), video tape (VT) and filmloop (FL). The producer, title and number of the A/V is also given.

The unit guide bibliography lists textbooks, audiovisuals and student manuals cited in the unit guides section.

The additional instructional materials is a compilation of textbooks not included in the unit guides but beneficial to educators.

Resources addresses for all references concludes this appendix.

CURRICULUM AREA: APPLIANCE REPAIR

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
EL-01 Identifying safe working conditions	Georgia: "Identifying Safe Working Conditions" (ST)	Althouse: Modern Refrigeration and Air Conditioning; Carrier Corp.: A Safety Guide for Refrigeration and Air Conditioning; Prentice-Hall: Refrigeration and Air Conditioning	Georgia: Refrigeration, Unit REF-02
EL-02 Using basic electrical theory	Georgia: "Understanding Basic Electrical Theory," (ST); Whirlpool: "Basic Electricity for Appliances," (TR)	Smith: Electricity for Refrigeration, Heating and Air Conditioning; Whirlpool: Basic Electricity for Appliances	Georgia: Electricity, Unit EL-01; Whirlpool: Basic Electricity for Appliances
EL-03 Computing Ohm's law and power formulas		Smith: Electricity for Refrigeration, Heating and Air Conditioning	Georgia: Electricity, Unit EL-02
EL-04 Using electric meters	Georgia: "Using Electric Meters," (ST)	Smith: Electricity for Refrigeration, Heating and Air Conditioning	Georgia: Electricity, Unit EL-03
EL-05 Identifying electrical symbols	Georgia: "Identifying Symbols," (ST)	Smith: Electricity for Refrigeration, Heating and Air Conditioning	Georgia: Electricity, Unit EL-05
EL-06 Drawing basic schematic diagrams	Georgia: "Reading a Basic Schematic Diagram," (ST)	Smith: Electricity for Refrigeration, Heating and Air Conditioning	Georgia: Electricity, Unit EL-06
EL-07 Laying out and wiring series and parallel circuits	Georgia: "Demonstrate a Knowledge of Series and Parallel Circuits," (ST)	Smith: Electricity for Refrigeration, Heating and Air Conditioning	Georgia: Electricity, Unit EL-04

CURRICULUM AREA: APPLIANCE REPAIR

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
EL-08 Reading and drawing advanced schematic diagrams		Smith: Electricity for Refrigeration, Heating and Air Conditioning	Georgia: Electricity, Unit EL-07
EL-09 Laying out, wiring and testing an alternating current (AC) circuit		Smith: Electricity for Refrigeration, Heating and Air Conditioning	Georgia: Electricity, Unit EL-08
EL-10 Selecting wire size and making connections	Georgia: "Determining, Selecting Wire Size and Making Connections," (ST)	Smith: Electricity for Refrigeration, Heating and Air Conditioning	Georgia: Electricity, Unit EL-09
EL-11 Making main panel connections	Georgia: "Making Main Panel Connections," (ST)	Smith: Electricity for Refrigeration, Heating and Air Conditioning	Georgia: Electricity, Unit EL-10
EL-12 Installing and testing shaded pole motors	Georgia: "Servicing Shaded Pole Motors," (ST)	Smith: Electricity for Refrigeration, Heating and Air Conditioning	Georgia: Electricity, Unit EL-11
EL-13 Installing and testing split phase motors	Georgia: "Servicing Shaded Pole Motors," (ST)	Smith: Electricity for Refrigeration, Heating and Air Conditioning	Georgia: Electricity, Unit EL-12
EL-14 Checking capacitors for serviceability	Georgia: "Checking Capacitors," (ST)	Smith: Electricity for Refrigeration, Heating and Air Conditioning	Georgia: Electricity, Unit EL-13
EL-15 Installing and testing permanent split capacitor (PSC) motors		Smith: Electricity for Refrigeration, Heating and Air Conditioning	Georgia: Electricity, Unit EL-14

CURRICULUM AREA: APPLIANCE REPAIR

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
EL-16	Installing and testing capacitor start (CS) motors	Georgia: "Hooking Up and Troubleshooting CS Motors," (ST)	Smith: Electricity for Refrigeration, Heating and Air Conditioning	Georgia: Electricity, Unit EL-15
EL-17	Installing and testing capacitor start/run (CSR) motors	Georgia: "Hooking Up and Troubleshooting a CSR Motor," (ST)	Smith: Electricity for Refrigeration, Heating and Air Conditioning	Georgia: Electricity, Unit EL-16
EL-18	Troubleshooting electric motors		Smith: Electricity for Refrigeration, Heating and Air Conditioning	Georgia: Electricity, Unit EL-18
EL-19	Servicing electric motors		Smith: Electricity for Refrigeration, Heating and Air Conditioning	Georgia: Electricity, Unit EL-19
EL-20	Installing 115 volt AC appliance circuits	Georgia: "Installing 115v Appliance Outlets," (ST); Bergwall: "Small Appliance Circuits," (FS)	Alerich: Electrical Construction Wiring	Georgia: Residential Electrical Wiring: Secondary, Unit REW-01; MAVCC: Residential Wiring
EL-21	Installing split switched receptacles	Georgia: "Installing Split and Switches Receptacles," (ST)	Alerich: Electrical Construction Wiring	Georgia: Residential Electrical Wiring: Secondary, Unit REW-04; MAVCC: Residential Wiring
EL-22	Installing 230 volt AC appliance circuits	Georgia: "Installing 230v Circuits and Outlets," (ST); Bergwall: "Special Purpose Outlets," (FS)	Alerich: Electrical Construction Wiring	Georgia: Residential Electrical Wiring: Secondary, Unit REW-07; MAVCC: Residential Wiring

CURRICULUM AREA: APPLIANCE REPAIR

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
EL-23 Using standard measurements			Georgia: Residential Electrical Wiring: Secondary, Unit REW-11; MAVCC: Residential Wiring; Georgia: Electro-Mechanics Mathematics, Chapter Nine
EL-24 Identifying and drawing electrical symbols	Georgia: "Identifying Residential Wiring Symbols and Designing Circuits," (ST)	Smith: Electricity for Refrigeration, Heating and Air Conditioning	Georgia: Residential Electrical Wiring: Secondary, Unit REW-12; MAVCC: Residential Wiring

CURRICULUM AREA: APPLIANCE REPAIR

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
AR-01	Installing and wiring an electric range	Georgia: "Installing Electric Range," (ST); "Transporting Major Appliances," (ST)	Ruel and Nolte: Servicing Electrical Appliances, Vol. 2; Alerich: Electrical Construction Wiring; Mullin: Electrical-Wiring-Residential	Georgia: Major Appliances: Secondary, Units MA-01, MA-09
AR-02	Installing and wiring a cook top	Georgia: "Installing Surface Unit and Hood," (ST); AAVIM: "Electrical Wiring," (ST)	Ruel and Nolte: Servicing Electrical Appliances, Vol. 2; Alerich: Electrical Construction Wiring; Mullin: Electrical-Wiring-Residential	Georgia: Major Appliances: Secondary, Unit MA-03; AAVIM: Electrical Wiring, 305SW
AR-03	Installing and wiring an electric oven	Georgia: "Installing Oven," (ST); AAVIM: "Electrical Wiring," (ST)	Alerich: Electrical Construction Wiring; Mullin: Electrical-Wiring-Residential	Georgia: Major Appliances; Secondary, Unit MA-02; AAVIM: Electrical Wiring, 305SW
AR-04	Installing and wiring an electric clothes dryer	AAVIM: "Electrical Wiring," (ST); Whirlpool: "Washer and Dryer Installation," (VT)	Ruel and Nolte: Servicing Electrical Appliances, Vol. 2; Alerich: Electrical Construction Wiring; Mullin: Electrical-Wiring-Residential	Georgia: Major Appliances: Secondary, Unit MA-04; AAVIM: Electrical Wiring, 305SW
AR-05	Installing and wiring an electric water heater	AAVIM: "Electrical Wiring," (ST)	Ruel and Nolte: Servicing Electrical Appliances, Vol. 1; Mullin: Electrical-Wiring-Residential	AAVIM: Electrical Wiring, 305SW
AR-06	Installing and wiring a microwave oven	AAVIM: "Electrical Wiring," (ST)	Mix: Housewiring Simplified; Mullin: Electrical-Wiring-Residential	AAVIM: Electrical Wiring, 305SW
AR-07	Installing and wiring a refrigerator or freezer	Georgia: "Transporting Major Appliances," (ST); AAVIM: "Electrical Wiring," (ST)	Mullin: Electrical-Wiring-Residential	Georgia: Major Appliances: Secondary, Units MA-08, MA-09; AAVIM: Electrical Wiring, 305SW

CURRICULUM AREA: APPLIANCE REPAIR

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
AR-08	Installing an ice maker		Althouse: Modern Refrigeration and Air Conditioning	
AR-09	Installing and wiring a trash compactor	AAVIM: "Electrical Wiring," (ST)	Ruel and Nolte: Servicing Electrical Appliances, Vol. 2; Mullin: Electrical Wiring-Residential	AAVIM: Electrical Wiring, 305SW
AR-10	Installing and wiring a dishwasher	AAVIM: "Electrical Wiring," (ST)	Ruel and Nolte: Servicing Electrical Appliances, Vol. 2; Mullin: Electrical Wiring-Residential	Georgia: Major Appliances: Secondary, Unit MA-06; AAVIM, Electrical Wiring, 305SW
AR-11	Installing, plumbing and wiring a clothes washer	AAVIM: "Electrical Wiring," (ST); Whirlpool: "Washer and Dryer Installation," (VT)	Ruel and Nolte: Servicing Electrical Appliances, Vol. 2; Mullin: Electrical Wiring-Residential	Georgia: Major Appliances: Secondary, Unit MA-05; AAVIM, Electrical Wiring, 305SW
AR-12	Installing and plumbing a gas range	Georgia: "Applying Gas Fuel Combustion and Safety Principles," (ST); "Transporting Major Appliances," (ST); "Gas Piping Principles," (ST)	National Training Aids: Cooking Service Training Manual; Oravetz: Plumbers and Pipefitters Library	Georgia: Heating: Post Secondary, Units HE-04, HE-07; Georgia: Major Appliances: Secondary, Unit MA-09
AR-13	Installing and plumbing a gas oven	Georgia: "Applying Gas Fuel Combustion and Safety Principles," (ST); "Gas Piping Principles," (ST)	National Training Aids: Cooking Service Training Manual; Oravetz: Plumbers and Pipefitters Library	Georgia: Heating: Post Secondary, Units HE-04 and HE-07
AR-14	Installing and plumbing a gas clothes dryer	Georgia: "Applying Gas Fuel Combustion and Safety Principles," (ST); "Gas Piping Principles," (ST)	Oravetz: Plumbers and Pipefitters Library	Georgia: Heating: Post Secondary, Units HE-04a and HE-07

CURRICULUM AREA: APPLIANCE REPAIR

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
AR-15	Installing and plumbing a gas water heater	Georgia: "Applying Gas Fuel Combustion and Safety Principles," (ST); "Gas Piping Principles," (ST)	National Training Aids: Water Heating Service Training Manual; Oravetz: Plumbers and Pipefitters Library; Slater and Smith: Basic Plumbing	Georgia: Heating: Post Secondary, Units HE-04 and HE-07
AR-16	Installing and plumbing a gas space heater	Georgia: "Applying Gas Fuel Combustion and Safety Principles," (ST); "Gas Piping Principles," (ST)	National Training Aids: Heating Service Training Manual; Oravetz: Plumbers and Pipefitters Library	Georgia: Heating: Post Secondary, Units HE-04a and HE-07
AR-17	Installing an outdoor gas grill	Georgia: "Applying Gas Fuel Combustion and Safety Principles," (ST); "Gas Piping Principles," (ST)	Oravetz: Plumbers and Pipefitters Library	Georgia: Heating: Post Secondary, Units HE-04a and HE-07
AR-18	Installing a gas appliance vent		Metalbestos: Gas Vent and Chimney Sizing Handbook; National Training Aids: Gas Water Heating, Cooking and Heating	Georgia: Heating: Post Secondary, Unit HE-14
AR-19	Testing electronic circuitry		Whirlpool: Electronics for Appliances	Whirlpool: Electronics for Appliances
AR-20	Testing and replacing surface units and oven heating elements	Georgia: "Test and Replace a Surface Unit Element," (ST)	Ruel and Nolte: Servicing Electrical Appliances; Vol. 1; Whirlpool: Range Service	Georgia: Major Appliances: Secondary, Units MA-26, MA-28; Whirlpool: Range Service
AR-21	Testing and replacing surface unit and oven temperature control switches and thermostats		Ruel and Nolte: Servicing Electrical Appliances, Vol. 1; Whirlpool: Range Service	Georgia: Major Appliances: Secondary, Units MA-27, MA-29; Whirlpool: Range Service

CURRICULUM AREA: APPLIANCE REPAIR

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
AR-22 Testing and replacing the oven timer		Ruel and Nolte: Servicing Electrical Appliances, Vol. 1; Whirlpool: Range Service	Georgia: Major Appliances: Secondary, Unit MA-30; Whirlpool: Range Service
AR-23 Testing and replacing ceramic cook tops		Whirlpool: Range Service	Whirlpool: Range Service, Electric
AR-24 Troubleshooting microwave ovens		Whirlpool: Range Service; Whirlpool: Electronics for Appliances	Whirlpool: Range Service; Whirlpool: Electronics for Appliances
AR-25 Servicing electric dryer mechanical systems		Ruel and Nolte: Servicing Electrical Appliances, Vol. 2; Whirlpool: Automatic Dryers	Georgia: Major Appliances: Secondary, Unit MA-16; Whirlpool: Automatic Dryers, Electric
AR-26 Servicing dryer electrical systems	Georgia: "Servicing Dryer Electrical System," (ST)	Ruel and Nolte: Servicing Electrical Appliances, Vol. 2; Whirlpool: Automatic Dryers	Georgia: Major Appliances: Secondary, Unit MA-17; Whirlpool: Automatic Dryers, Electric
AR-27 Testing and replacing electric water heater elements		Ruel and Nolte: Servicing Electrical Appliances, Vol. 1	
AR-28 Testing and replacing electric water heater thermostats		Ruel and Nolte: Servicing Electrical Appliances, Vol. 1	
AR-29 Testing and replacing the dishwasher time and solenoids		Ruel and Nolte: Servicing Electrical Appliances, Vol. 2; Whirlpool: Dishwashers, Trash Mashers and Disposers	Georgia: Major Appliances: Secondary, Units MA-18, MA-21, MA-24

CURRICULUM AREA: APPLIANCE REPAIR

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
AR-30	Testing and replacing dishwasher level control and door switches		Ruel and Nolte: Servicing Electrical Appliances, Vol. 2; Whirlpool: Dishwashers, Trash Mashers and Disposers	Georgia: Major Appliances: Secondary, Unit MA-19
AR-31	Testing and replacing the dishwasher heating element and thermostat		Ruel and Nolte: Servicing Electrical Appliances, Vol. 2; Whirlpool: Dishwashers, Trash Mashers and Disposers	Georgia: Major Appliances: Secondary, Unit MA-20
AR-32	Testing and replacing the dishwasher automatic dispenser		Ruel and Nolte: Servicing Electrical Appliances, Vol. 2; Whirlpool: Dishwashers, Trash Mashers and Disposers	Georgia: Major Appliances: Secondary, Unik MA-22
AR-33	Testing and replacing the dishwasher drain pump		Ruel and Nolte: Servicing Electrical Appliances, Vol. 2; Whirlpool: Dishwashers, Trash Mashers and Disposers	Georgia: Major Appliances: Secondary, Unit MA-23
AR-34	Testing and replacing the dishwasher motor and relay		Ruel and Nolte: Servicing Electrical Appliances, Vol. 2; Whirlpool: Dishwashers, Trash Mashers and Disposers	Georgia: Major Appliances: Secondary, Unit MA-21
AR-35	Testing and replacing the clothes washer timer and solenoids	Georgia: "Total Washing Machine Operation," (ST); "Electrical Systems Operation and Troubleshooting," (ST)	Ruel and Nolte: Servicing Electrical Appliances, Vol. 2; Whirlpool: Automatic Washers	Georgia: Major Appliances: Secondary, Units MA-10, MA-11; Whirlpool: Automatic Washers
AR-36	Testing and replacing the clothes washer level control and door switches	Georgia: "Electrical Systems Operation and Troubleshooting," (ST)	Ruel and Nolte: Servicing Electrical Appliances, Vol. 2; Whirlpool: Automatic Washers	Georgia: Major Appliances: Secondary, Unit MA-11; Whirlpool: Automatic Washers

CURRICULUM AREA: APPLIANCE REPAIR

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
AR-37	Checking and replacing the clothes washer agitator		Ruel and Nolte: Servicing Electrical Appliances, Vol. 2; Whirlpool: Automatic Washers	Whirlpool: Automatic Washers
AR-38	Testing and repairing the clothes washer drain pump	Georgia: "Water Systems Operation and Troubleshooting," (ST)	Ruel and Nolte: Servicing Electrical Appliances, Vol. 2; Whirlpool: Automatic Washers	Georgia: Major Appliances: Secondary, Unit MA-15; Whirlpool: Automatic Washers
AR-39	Testing and replacing the clothes washer clutch and transmission	Georgia: "Mechanical Systems Operation and Troubleshooting," (ST)	Ruel and Nolte: Servicing Electrical Appliances, Vol. 2; Whirlpool: Automatic Washers	Georgia: Major Appliances: Secondary, Unit MA-13; Whirlpool: Automatic Washers
AR-40	Servicing and replacing the clothes washer motor and relay	Georgia: "Electrical Systems Operation and Troubleshooting," (ST)	Whirlpool: Automatic Washers; Ruel and Nolte: Servicing Electrical Appliances, Vol. 2	Georgia: Major Appliances: Secondary, Unit MA-11; Whirlpool: Automatic Washers
AR-41	Heating and cooking with petroleum gases	Georgia: "Applying Gas Fuel Combustion and Safety Principles," (ST)	National Training Aids: Gas Water Heating, Cooking and Heating	Georgia: Heating: Post Secondary, Unit HE-04
AR-42	Inspecting heat exchangers	Georgia: "Inspecting and Determining Heat Rise of Heat Exchangers," (ST)	National Training Aids: Heating Service Training Manual	Georgia: Heating: Post Secondary, Unit HE-13; National Training Aids: Gas Heating, Student Workbook
AR-43	Replacing gas orifices		National Training Aids: Gas Water Heating, Cooking and Heating	

CURRICULUM AREA: APPLIANCE REPAIR

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
AR-44	Adjusting pilot lights	Georgia: "Installing and Servicing Pilot Ignition Devices," (ST)	National Training Aids: Gas Water Heating, Cooking and Heating	Georgia: Heating: Post Secondary, Unit HE-10
AR-45	Replacing and adjusting main gas burners	Georgia: "Servicing Burners," (ST)	National Training Aids: Gas Water Heating, Cooking and Heating	Georgia: Heating: Post Secondary, Unit HE-12; National Training Aids: Fundamentals of Gas Control Systems, Student Workbook
AR-46	Replacing and adjusting gas regulators	Georgia: "Adjusting Regulators," (ST)	National Training Aids: Gas Water Heating, Cooking and Heating	Georgia: Heating: Post Secondary, Unit HE-08; National Training Aids: Fundamentals of Gas Control Systems, Student Workbook
AR-47	Testing, replacing and adjusting combination diaphragm valves	Georgia: "Installing and Servicing Combination Gas Valves," (ST)	National Training Aids: Gas Heating, Cooking and Heating	Georgia: Heating: Post Secondary, Unit HE-11; National Training Aids: Fundamentals of Gas Control Systems, Student Workbook
AR-48	Testing and replacing electromagnetic safety devices	Georgia: "Installing and Servicing Pilot Ignition Devices," (ST)	National Training Aids: Gas Water Heating, Cooking and Heating	Georgia: Heating: Post Secondary, Unit HE-10; National Training Aids: Fundamentals of Gas Control Systems, Student Workbook
AR-49	Testing, replacing and adjusting gas oven controls		National Training Aids: Cooking Service Training Manual	Whirlpool: Range Service, Gas

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
AR-50 Testing, replacing and adjusting gas range controls		National Training Aids: Cooking Service Training Manual	Whirlpool: Range Service Gas
AR-51 Testing, replacing and adjusting gas/electric controls		National Training Aids: Cooking Service Manual; Whirlpool: Range Service	Whirlpool: Range Service; National Training Aids: Fundamentals of Gas Controls Systems, Student Workbook
AR-52 Testing and replacing gas water heater relief valves		National Training Aids: Water Heating Service Training Manual	National Training Aids: Gas Water Heating Systems, Student Workbook
AR-53 Testing and replacing gas water heater thermostats		National Training Aids: Water Heating Service Training Manual	National Training Aids: Gas Water Heating Systems, Student Workbook
AR-54 Testing, replacing and adjusting water heater gas controls		National Training Aids: Water Heating Service Training Manual	National Training Aids: Gas Water Heating Systems, Student Workbook
AR-55 Servicing gas clothes dryer mechanical/electrical systems		Whirlpool: Automatic Dryers	Whirlpool: Automatic Dryers
AR-56 Testing, replacing and adjusting dryer gas controls		Whirlpool: Automatic Dryers	Whirlpool: Automatic Dryers; National Training Aids: Fundamentals of Gas Control Systems, Student Workbook

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
AR-57 Testing, replacing and adjusting gas space heater thermostats	Georgia: "Servicing Electrical Controls," (ST)	National Training Aids: Heating Service Training Manual	National Training Aids: Gas Heating Control Systems, Student Workbook; Georgia: Heating: Post Secondary, Unit HE-15
AR-58 Testing, replacing and adjusting space heater fan and controls	Georgia: "Servicing Electrical Controls," (ST)	National Training Aids: Heating Service Training Manual	National Training Aids: Gas Heating Controls Systems, Student Workbook; Georgia: Heating: Post Secondary, Unit HE-15
AR-59 Testing, replacing and adjusting space heater gas controls		National Training Aids: Heating Service Training Manual	National Training Aids: Gas Heating Control Systems, Student Workbook
AR-60 Testing, replacing and adjusting outdoor grill gas controls			National Training Aids: Fundamentals of Gas Control Systems, Student Workbook

CURRICULUM AREA: APPLIANCE REPAIR

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
RF-01 Demonstrating a knowledge of the basic refrigeration concepts	Georgia: "Understanding Basic Refrigeration Concepts," (ST)	Prentice-Hall: Refrigeration and Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning	Georgia: Refrigeration; Copeland Manuals
RF-02 Describing the function of the basic refrigeration cycle components	Georgia: "Understanding the Basic Refrigeration Cycle," (ST)	Prentice-Hall: Refrigeration and Air Conditioning; Delmar: Principles of Refrigeration	Georgia: Refrigeration; Copeland Manuals
RF-03 Using refrigeration tools	Georgia: "Identifying Tools," (ST)	Prentice-Hall: Refrigeration and Air Conditioning; Delmar: Principles of Refrigeration	Georgia: Refrigeration
RF-04 Drilling, tapping and threading	Georgia: "Tapping, Threading and Replacing Threads," (ST)	Prentice-Hall: Refrigeration and Air Conditioning; Delmar: Principles of Refrigeration	Georgia: Refrigeration
RF-05 Identifying tubing and pipe fittings		Prentice-Hall: Refrigeration and Air Conditioning; Delmar: Principles of Refrigeration	Georgia: Refrigeration
RF-06 Performing basic copper tubing operations	Georgia: "Basic Copper Tubing Operations," (ST)	Prentice-Hall: Refrigeration and Air Conditioning; Delmar: Principles of Refrigeration	Georgia: Refrigeration
RF-07 Soft soldering copper tubing	Georgia: "Soft Soldering Copper Tubing," (ST)	Prentice-Hall: Refrigeration and Air Conditioning; Delmar: Principles of Refrigeration	Georgia: Refrigeration

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
RF-08 Silver brazing	Georgia: "Silver Brazing," (ST)	Prentice-Hall: Refrigeration and Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Delmar: Principles of Refrigeration	Georgia: Refrigeration
RF-09 Handling refrigerants	Georgia: "Handling Refrigerants," (ST)	Prentice-Hall: Refrigeration and Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Delmar: Principles of Refrigeration	Georgia: Refrigeration; Copeland Manuals
RF-10 Installing and using access valves	Georgia: "Using Access Valves," (ST)	Prentice-Hall: Refrigeration and Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Delmar: Principles of Refrigeration	Georgia: Refrigeration; Copeland Manuals
RF-11 Maintaining refrigeration manifold gauges	Georgia: "Maintaining Refrigeration Manifold Changes," (ST)	Prentice-Hall: Refrigeration and Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Delmar: Principles of Refrigeration	Georgia: Refrigeration; Copeland Manuals
RF-12 Installing and using refrigeration manifold gauges		Prentice-Hall; Refrigeration and Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Delmar: Principles of Refrigeration	Georgia: Refrigeration; Copeland Manuals

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
RF-13 Evacuating a refrigeration system	Georgia: "Using a Vacuum Pump," (ST)	Prentice-Hall: Refrigeration and Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Delmar: Principles of Refrigeration	Georgia: Refrigeration; Carrier: GTR Manuals; Copeland Manuals
RF-14 Installing refrigeration accessories	Georgia: "Installing Refrigeration Accessories," (ST)	Prentice-Hall: Refrigeration and Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Delmar: Principles of Refrigeration	Georgia: Refrigeration; Copeland Manuals; Carrier: GTR Manuals
RF-15 Testing for leaks	Georgia: "Testing for Leaks," (ST)	Prentice-Hall: Refrigeration and Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Delmar: Principles of Refrigeration	Georgia: Refrigeration; Copeland Manuals; Carrier: GTR Manuals
RF-16 Charging the system	Georgia: "Charging the System," (ST); Westinghouse: "STV-GSI Program," (ST)	Prentice-Hall: Refrigeration and Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Delmar: Principles of Refrigeration	Georgia: Refrigeration; Copeland Manuals; Carrier: GTR Manuals
RF-17 Testing the compressor	Georgia: "Testing the Compressor," (ST): Carrier: "GTR Refrigeration Program," (ST)	Prentice-Hall: Refrigeration and Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Delmar: Principles of Refrigeration	Georgia: Refrigeration; Copeland Manuals; Carrier: GTR Manuals

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
RF-18 Troubleshooting condensers	Carrier: "GTR Refrigeration Program," (ST)	Prentice-Hall: Refrigeration and Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Delmar: Principles of Refrigeration	Georgia: Refrigeration; Copeland Manuals; Carrier: GTR Manuals
RF-19 Troubleshooting evaporators	Carrier: "GTR Refrigeration Program," (ST)	Prentice-Hall: Refrigeration and Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Delmar: Principles of Refrigeration	Georgia: Refrigeration; Copeland Manuals; Carrier: GTR Manuals
RF-20 Troubleshooting an automatic expansion valve		Prentice-Hall: Refrigeration and Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Delmar: Principles of Refrigeration	Georgia: Refrigeration; Copeland Manuals; Carrier: GTR Manuals
*RF-21 Troubleshooting capillary tubes		Prentice-Hall: Refrigeration and Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Delmar: Principles of Refrigeration	Georgia: Refrigeration; Copeland Manuals; Carrier: GTR Manuals
RF-22 Troubleshooting thermostatic expansion valves	Georgia: "Troubleshooting a Thermostatic Expansion Valve," (ST)	Prentice-Hall: Refrigeration and Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Delmar: Principles of Refrigeration	Georgia: Refrigeration; Copeland Manuals; Carrier: GTR Manuals

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
RF-23 Troubleshooting the refrigeration system		Prentice-Hall: Refrigeration and Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Delmar: Principles of Refrigeration	Georgia: Refrigeration; Copeland Manuals; Carrier: GTR Manuals
RF-24 Installing a window air conditioning unit	Georgia: "Installation of a Window Unit," (ST)	Delmar: Principles of Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Prentice-Hall: Refrigeration and Air Conditioning	Georgia: Air Conditioning: Post Secondary, Unit AC-06; Refrigeration: Secondary, Unit REF-26
RF-25 Performing pre-season start-up maintenance on window air conditioning units	Georgia: "Performing Pre-Season Start-Up," (ST)	Delmar: Principles of Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Prentice-Hall: Refrigeration and Air Conditioning	Georgia: Air Conditioning: Post Secondary, Unit AC-07; Refrigeration: Secondary, Unit REF-27
RF-26 Troubleshooting compressor burnout in window air conditioners	Georgia: "Troubleshooting Compressor Burn Out in a Window Air Conditioner," (ST)	Delmar: Principles of Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Prentice-Hall: Refrigeration and Air Conditioning	Georgia: Air Conditioning: Post Secondary, Unit AC-08; Refrigeration: Secondary, Unit REF-28
RF-27 Evacuating and charging window air conditioners	Georgia: "Evacuating and Charging a Window Air Conditioner," (ST)	Delmar: Principles of Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Prentice-Hall: Refrigeration and Air Conditioning	Georgia: Air Conditioning: Post Secondary, Unit AC-09; Refrigeration: Secondary, Unit REF-29

CURRICULUM AREA: APPLIANCE REPAIR

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
RF-28	Troubleshooting fans and fan motors	Georgia: "Troubleshooting Fans and Fan Motors," (ST)	Delmar: Principles of Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Prentice-Hall: Refrigeration and Air Conditioning	Georgia: Air Conditioning: Post Secondary, Unit AC-10; Refrigeration: Secondary, Unit REF-30
RF-29	Troubleshooting mechanical problems in window air conditioner refrigeration cycle	Georgia: "Troubleshooting Window Air Conditioner Refrigeration Cycle," (ST)	Delmar: Principles of Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Prentice-Hall: Refrigeration and Air Conditioning	Georgia: Air Conditioning: Post Secondary, Unit AC-11; Refrigeration: Secondary, Unit REF-31
RF-30	Troubleshooting a window air conditioner electrical system	Georgia: "Troubleshooting Window Air Conditioning Electrical System," (ST)	Delmar: Principles of Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Prentice-Hall: Refrigeration and Air Conditioning	Georgia: Air Conditioning: Post Secondary, Unit AC-12; Refrigeration: Secondary, Unit REF-32
RF-31	Identifying and describing the function of the refrigeration components	Georgia: "Understanding Basic Operation," (ST)	Prentice-Hall: Refrigeration and Air Conditioning	Georgia: Refrigeration: Secondary, Units REF-33; MAVCC: Air Conditioning and Refrigeration, Book Two
RF-32	Evacuating and charging domestic refrigerator and freezer systems	Georgia: "Evacuating and Charging Refrigerators and Freezers," (ST)	Prentice-Hall: Refrigeration and Air Conditioning	Georgia: Refrigeration: Secondary, Unit REF-34; MAVCC: Air Conditioning and Refrigeration, Book One
RF-33	Testing and replacing the refrigeration cycle components	Georgia: "Troubleshooting Refrigeration Cycle," (ST)	Althouse: Modern Refrigeration and Air Conditioning	Georgia: Refrigeration: Secondary, Unit REF-35; MAVCC, Air Conditioning and Refrigeration, Book Two

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
RF-34 Troubleshooting refrigerator/freezer compressor burnout	Georgia: "Troubleshooting Compressor Burn Out," (ST)	Doolin: Doolin's Troubleshooter's Bible	Georgia: Refrigeration: Secondary, Unit REF-37; MAVCC: Air Conditioning and Refrigeration, Book Two
RF-35 Testing and replacing refrigerator/freezer fans and fan motors	Georgia: "Troubleshooting Fans and Fan Motors," (ST)	Althouse: Modern Refrigeration and Air Conditioning	Georgia: Refrigeration: Secondary, Unit REF-36; MAVCC: Air Conditioning and Refrigeration, Book Two
RF-36 Diagnosing problems in refrigerators and freezers		Doolin: Doolin's Troubleshooter's Bible	Georgia: Refrigeration: Secondary, Unit REF-38; MAVCC: Air Conditioning and Refrigeration, Book Two

UNIT GUIDE REFERENCES

Textbooks, audiovisual producers, student manuals and evaluation materials contained in the unit guide sheets are listed here. Addresses for the publishers may be found in the "Resource Addresses" which concludes this section.

TEXTBOOKS

Alerich, W. N., Electrical Construction Wiring. Chicago, IL: American Technical Society, 1971.

Althouse, A. D., Turnquist, C. H. and Bracciano, A. F., Modern Refrigeration and Air Conditioning. South Holland, IL: The Goodheart-Willcox Company, Inc., 1979.

Carrier, A Safety Guide for Refrigeration and Air Conditioning. Syracuse, NY: Carrier Corporation.

Delmar, Principles of Refrigeration. Albany, NY: Delmar Publishers, 1979.

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National Training Aids, Inc., Cooking Service Training Manual. Atlanta, GA: 1976.

National Training Aids, Inc., Gas Water Heating, Cooling and Heating Combined Service Manual. Atlanta, GA: 1979.

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Prentice-Hall, *Refrigeration and Air Conditioning*. Englewood Cliffs, NJ: 1979.

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Whirlpool, *Automatic Washers*. Benton Harbor, MI: Whirlpool Corp.

Whirlpool, *Basic Electricity for Appliances*. Benton Harbor, MI: Whirlpool, Corp.

Whirlpool, *Dishwashers, Trash Mashers and Disposers*. Benton Harbor, MI: Whirlpool, Corp.

Whirlpool, *Electronics for Appliances*. Benton Harbor, MI: Whirlpool, Corp.

Whirlpool, *Range Service*. Benton Harbor, MI: Whirlpool, Corp.

AUDIOVISUALS

American Association for Vocational Instruction Materials (AAVIM)	Slides
Bergwall	Flimstrips
Carrier	Slides
Georgia	Slides
Westinghouse	Slides
Whirlpool	Video Tapes

STUDENT MANUALS

AAVIM, Electric Wiring: Residential, Utility Building and Service Areas: Student Workbook. Athens, GA: American Association for Vocational Instructional Materials, 1979.

Carrier, GTR Manuals. Syracuse, NY: Carrier Corporation.

Copeland, Refrigeration Student Manuals. Sidney, OH: Copeland Corporation.

Georgia, Air Conditioning: Post Secondary REACH. Atlanta, GA: Georgia Department of Education, 1980.

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Georgia, Electro-Mechanics Mathematics. Atlanta, GA: Georgia Department of Education, 1980.

Georgia, Heating: Post Secondary REACH. Atlanta, GA: Georgia Department of Education, 1980.

Georgia, Major Appliances: Secondary REACH. Atlanta, GA: Georgia Department of Education, 1980.

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Whirlpool, Automatic Dryers, Gas. Benton Harbor, MI: Whirlpool Corp.

Whirlpool, Automatic Washers: Student Manual. Benton Harbor, MI: Whirlpool Corp.

Whirlpool, Basic Electricity for Appliances: Student Workbook. Benton Harbor, MI: Whirlpool Corp.

Whirlpool, Electronics for Appliances: Student Workbook. Benton Harbor, MI: Whirlpool Corp.

Whirlpool, Range Service, Electric. Benton Harbor, MI: Whirlpool Corp.

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EVALUATION

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Georgia, Heating and Air Conditioning, Instructor Guide REACH, Vol. IV. Atlanta, GA: Georgia State Department of Education, 1980.

MAVCC, Air Conditioning and Refrigeration, Teacher Edition. Stillwater, OK: Mid-American Vocational Curriculum Consortium, 1978.

MAVCC, Residential Wiring, Teacher Edition. Stillwater, OK: Mid-American Vocational Curriculum Consortium, 1978.

V'TECS, Appliance Repairer. Atlanta, GA: Southern Association of Schools and Colleges, 1980.

ADDITIONAL INSTRUCTIONAL MATERIALS

The additional instructional materials provide supplementary resources that are not referenced in the Unit Guides section.

The following audiovisuals, textbooks and service manuals are produced by industry and media companies. This information can be updated by consulting Books in Print and Index to Vocational and Technical Education.

Addresses for these producers may be found in the "Resource Addresses" which concludes this section.

AUDIOVISUALS

Eye Gate House
  "Appliance Repairman" (FS)

Georgia Power
  "Applying for a Job" (MF)
  "Electric Safety from A to Zap" (MF)
  "Electricity" (MF)
  "Housewiring" (ST)
  "I Guess I Got the Job" (MF)
  "I'm No Fool for Electricity" (MF)
  "Our Friend the Atom" (MF)
  "Principles of Electricity" (MF)
  "What are Metrics" (MF)

National Audiovisual Center
  "AC Motors" (MF)
  "Amperes, Volts and Ohms" (MF)
  "Basic DC Meter Movement" (MF)
  "Basic Electricity - AC Parallel Circuits" (MF)
  "Basic Electricity AC Series Circuits" (MF)
  "Basic Electricity - Capacitance in AC Circuits" (MF)
  "Basic Electricity - Inductance in AC Circuits" (MF)
  "Electrical Circuit Faults" (MF)
  "Ohms Law" (MF)
  "Oxy-Acetylene Welding-Light Metal" (FS)
  "Refrigeration-Principles of Mechanical Operation"
  "The Electron Theory" (MF)
  "The Steel Rule" (MF)
  "Volt-Ohmmeter Operation" (MF)
  "What Causes Current Flow - EMF" (MF)
  "What Controls Current Flow - Resistance" (MF)
  "Wire Sizes and Voltage Drop" (MF)

Prentice-Hall Media
  "Electricity and Electronics - Safety" (FS)
  "Plumbing, Heating, Air Conditioning and Refrigeration" (FS)

TEXTBOOKS

Adams, J.T., *Electricity and Electric Appliances Handbook*. New York: Arco Publishing Inc., 1976.

Anderson, E.P., *Home Appliance Servicing*. Indianapolis: Bobbs-Merrill, 1974.

Browne, D., *Simplified Home Appliance Repairs*. New York: Holt, Rinehart & Winston Inc., 1978.

Bryant, C. and Seitz, C., *All About Repairing Major Household Appliances*. New York: Dutton, E.P., 1974.

Castellano, *You Fix It: Washing Machines*. New York: Arco Publishing Inc., 1972.

Darack, A., *The Guide to Home Appliance Repair*. New York: Mc-Graw-Hill, 1979.

Porter, C., *Basic Appliance Repair, Vol. 1: Dishwashers, Garbage Disposers, Electric Ranges and Ovens*. Rochelle Park, NJ: Hayden Book Co., 1971.

Rudman, J., *Appliance Repair (Occupational Competency Examination)*. Syosset, NY: National Learning Corp.

Scharff, B., *Refrigeration, Air Conditioning, Range & Oven Servicing*. New York: McGraw-Hill, 1976.

Schultz, M., *Popular Mechanics Complete Appliance Repair Manual*. New York: Hearst Books, 1975.

Thypin, M. and Glasner, L., *When Things Don't Work*. St. Paul, MN: EMC Corp., 1979.

Tricomi, E., *How to Repair Major Appliances*. New York: Bobbs-Merrill, 1970.

Wheeler, G., *How to Repair Electrical Appliances*. Reston, VA: Reston Publishing Co., 1972.

SERVICE MANUALS

Absocold Corporation

Addison Products Company

Admiral

Atlanta Stove Works

Knight Energy Institute

Broan Manufacturing Company

Carrier Air Conditioning Group

Ebco Manufacturing Company

Fedders Corporation

Friedrich

General Electric

Gibosn Appliance Company

GR Manufacturing

Hardwick Stove

Hobart Corporation

Hoover Company

Kelvinator

Magic Chef

Maytag Company

Master Publications

Roper Appliance

Tappan Company

Whirlpool Corporation

White - Westinghouse Corporation

RESOURCE ADDRESSES

AAVIM
120 Engineering Center
Athens, GA 30602

Absocold Corporation
1751 Sheridan Street
Richmond, IN 47374

Addison Products Company
Service Department
P.O. Box 100
Addison, MI 49220

Admiral
Division of Magic Chef
903 Morrissey Drive
Bloomington, IL 61701

American Technical Society
5608 Stony Island Avenue
Chicago, IL 60637

ARCO Publishing, Inc.
Division of Prentice-Hall
219 Park Avenue, South
New York, NY 10003

Atlanta Stove Works
P.O. Box 5254
Station E
Atlanta, GA 30307

Bergwall Productions, Inc.
839 Stewart Avenue
Garden City, NY 11530

Bobbs-Merrill Educational Publishing
Department No. 627
4300 West 62nd Street
P.O. Box 7080
Indianapolis, IN 46206

Broan Manufacturing Company
926 West State Street
Hartford, WI 53027

Carrier Air Conditioning Group
CAC Customer Assurance, SL-2
P.O. Box 4808
Syracuse, NY 13221

Copeland: Copeland Corporation
Sidney, OH 45365

Delmar Publications
50 Wolf Road
Albany, NY 12205

Doolco, Inc.
2016 Canton
Dallas, TX 75226

Dutton, E. P.
2 Park Avenue
New York, NY 10016

Duxbury Press
North Scituate, MA 02060

Ebco Manufacturing Company
265 North Hamilton Road
Columbus, OH 43213

EMC Corporation
180 E. Sixth Street
St. Paul, MN 55101

Eye Gate House, Inc.
146-01 Archer Avenue
Jamaica, NY 11435

The Fedders Corporation
Woodbridge Avenue
Edison, NJ 08817

Friedrich Air Conditioning and Refrigeration Company
RAC Service Department
4200 PanAm Expressway
P.O. Box 1540
San Antonio, TX 78295

General Electric Company
114 Watterson City-East
Louisville, KY 40225

Georgia Office of Vocational Education
Georgia Department of Education
Atlanta, GA 30334

Georgia Power
Film Library
4705-F Bakers Ferry Road
Atlanta, GA 30336

Gibson Appliance Company
Gibson Appliance Center
Greenville, MI 48838

Goodheart-Willcox Company
123 W. Taft Drive
South Holland, IL 60473

GR Manufacturing
1545 Clyde Park, S.W.
Grand Rapids, MI 49509

Hayden Book Co., Inc.
Essex Street
Rochelle Park, NJ 07662

Hardwick Stove Company
240 Edwards Street, S.E.
Cleveland, TN 37311

Hearst Books
224 W. 57th Street
Room 307
New York, NY 10019

Hobart Corporation
Kitchen Aid Division
World Headquarters Avenue
Troy, OH 45374

Holt, Rinehart & Winston, Inc.
383 Madison Avenue
New York, NY 10017

The Hoover Company
101 East Maple Street
North Canton, OH 44720

Kelvinator Appliance Company
930 Ft. Duquesne Boulevard
Pittsburgh, PA 15222

Knight Energy Institute
Jackson Community College
2111 Emmons Road
Jackson, MI 49201

Master Publications, Inc.
1660 Euclid Street
Santa Monica, CA 90404

MAVCC
1515 West Sixth Avenue
Stillwater, OK 74074

The Maytag Company
403 West 4th Street, North
Newton, IA 50208

Magic Chef
740 King Edward Avenue
Cleveland, TN 37311

Metalbestos Products
P.O. Box 137
Belmont, CA 94002

National Audiovisual Center
Regerence Section/RL
General Services Administration
Washington, DC 20409

National Fire Protection
Association
470 Atlantic Avenue
Boston, MA 02210

National Learning Corp.
212 Michael Drive
Syosset, NY 11791

National Training Aids, Inc.
Manual Division "M"
P.O. Box 565
Norcross, GA 30091

Prentice-Hall Media
ServCode VD3
150 White Plains Road
Tarrytown, NY 10591

Reston Publishing Co., Inc.
11480 Sunset Hills Road
Reston, VA 22090

Roper Appliance
2207 West Station Street
Kankakee, IL 60901

Tappan Company
Service Department
250 Wayne
Mansfield, OH 44903

V'TECS
Southern Association of
Colleges and Schools
795 Peachtree Street, N.E.
Atlanta, GA 30365

Vocational Educational
Materials Center
Green Street
The University of Georgia
Athens, GA 30602

Westinghouse Corporation
P.O. Box 4022
Elyria, OH 44036

Whirlpool Corporation
Technical Training Center
Benton Harbor, MI 49022

White-Westinghouse Corporation
Consumer Service
930 Ft. Duquesne Boulevard
Pittsburgh, PA 15222

APPENDIX B

Special Needs

WORKING WITH SPECIAL NEEDS STUDENTS*

Introduction

Special needs population students are those who are designated as handicapped or disadvantaged. The 1976 vocational education amendments define handicapped individuals as:

> Persons who are mentally retarded, hard of hearing, deaf, speech impaired, visually handicapped, seriously emotionally disturbed, orthopedically impaired, health impaired, or persons with other specific disabilities, who by reason thereof require special education and related services and who cannot succeed in the regular vocational education programs.

In those same amendments disadvantaged persons are defined as:

> Persons (other than handicapped persons) who have academic or economic disadvantages and who require special services, assistance or programs in order to enable them to succeed in vocational education programs.

Federal legislation requires that these special needs population students be given an opportunity to function in regular vocational education programs (Essentially, this is what is meant by the term mainstreaming.). This section provides information on how such students are identified and how they can be mainstreamed into regular vocational education environments.

Figure One presents a conceptual model depicting various activities of the process in identifying and mainstreaming special needs students in vocational education. These activities

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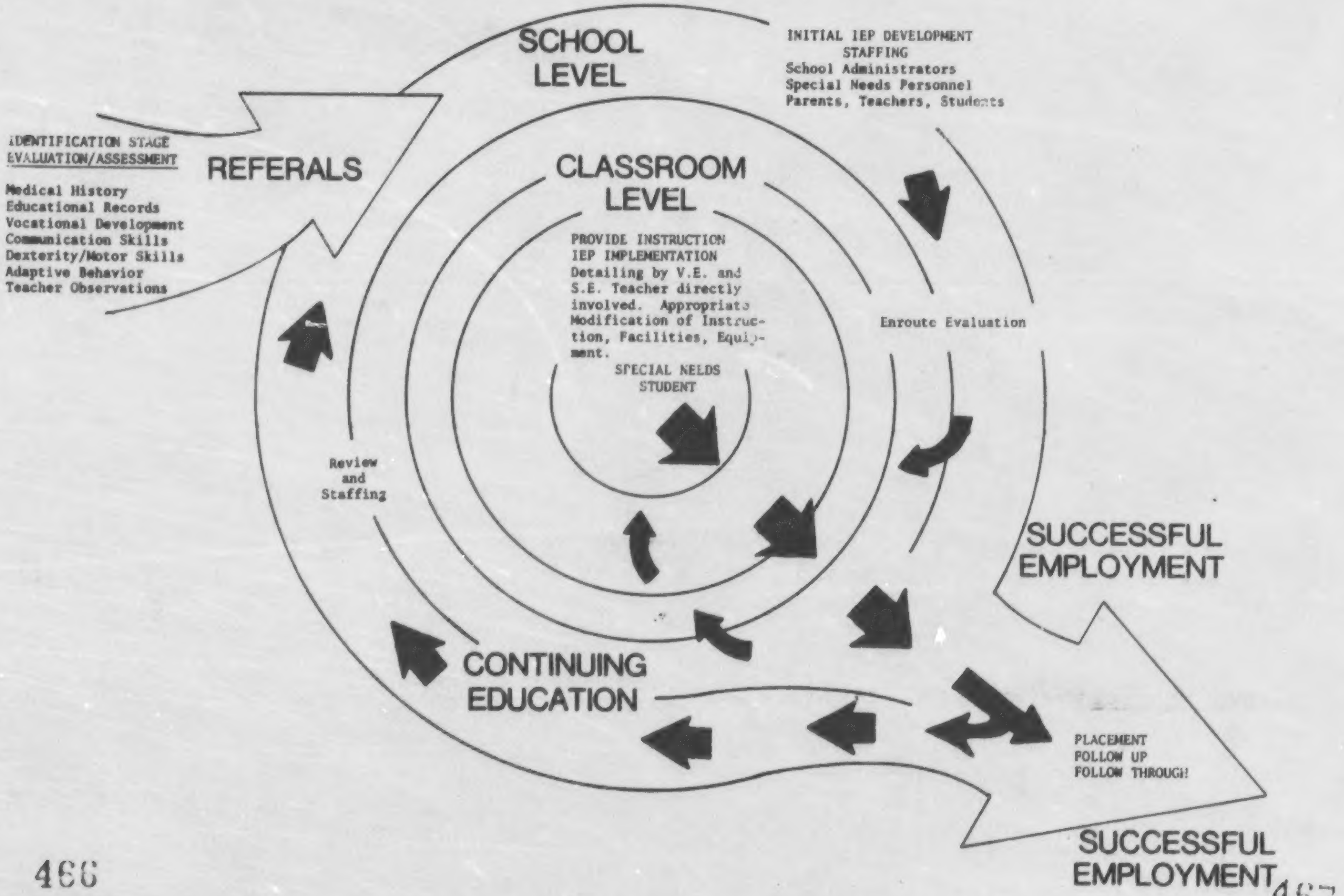
THE CONCEPT OF MAINSTREAMING


SCHOOL LEVEL
INITIAL IEP DEVELOPMENT
STAFFING
School Administrators
Special Needs Personnel
Parents, Teachers, Students
IDENTIFICATION STAGE
EVALUATION/ASSESSMENT
Medical History
Educational Records
Vocational Development
Communication Skills
Dexterity/Motor Skills
Adaptive Behavior
Teacher Observations
REFERALS
CLASSROOM LEVEL
PROVIDE INSTRUCTION
IEP IMPLEMENTATION
Detailing by V.E. and S.E. Teacher directly involved. Appropriate Modification of Instruction, Facilities, Equipment.
SPECIAL NEEDS STUDENT
Enroute Evaluation
Review and Staffing
SUCCESSFUL EMPLOYMENT
CONTINUING EDUCATION
PLACEMENT
FOLLOW UP
FOLLOW THROUGH!
SUCCESSFUL EMPLOYMENT

are conducted at three levels: the community level, the school level (Career Development Center) and the classroom level. All three levels must work together if implementation of the process is to be effective.

Identification of the Special Needs Student

Through a variety of pre-testing procedures, special needs students are identified and their potentials are evaluated at the community level. This evaluation process consists of collecting and assessing the following data for each student:

- -Medical History
- -Educational Records
- -Vocational Development
- -Communication Skills
- -Dexterity/Motor Skills
- -Adaptive Behavior
- -Teacher Observations

When this procedure has been completed, the community personnel refers the student to the appropriate school level personnel. As a part of the referral and school intake process, an Individualized Educational Plan should be initiated.

> The Individualized Educational Plan (IEP) is exactly what its name implies--a plan for the education of a specific individual. The base content of the IEP is outlined in Public Law 94-142. According to that outline, the IEP must include at least the following information: (a) student's present level of functioning, (b) his/her long range instructional objectives, (c) his/her short-range instructional objectives and finally, (d) some criteria to determine that those objectives have been achieved.

Development of the Individual Education Plan

It would be very difficult to anticipate the exact kind or type of special needs students one might find in a Appliance Repair program at any one time. The terms disadvantaged and handicapped are really "catch-all" terms that indicate a wide assortment of problems that might occur in a student representing one of these populations. Inaddition to the lack of a specific definition and the fact that the typical vocational instructor has had very little preparation in working with these students, it becomes clear that you will need a basic plan to use in meeting their occupational preparation needs. The following steps can serve as your basic planning procedure for mainstreaming a special needs population student into your curriculum.

The first step occurs after you have been notified that a special needs student can profit from being in your vocational program. When you have received that notification, you should contact your coordinator of student personnel services and ask for a detailed report of the student's assessed status. Note the word assessed; it is critical. Through a formal assessment status, appropriate school personnel and community should have identified the student's strengths and weaknesses as well as the specific handicapping conditions. After you have received the assessment information and understand it you are ready for Step Two.

Step Two, developing (or completing) the vocational aspects of the Individual Education Plan-IEP, is usually performed for handicapped students only; however, it has just as much merit for the disadvantaged. The IEP is a very useful tool. It should be considered the description of what you expect that student to be able to do when he or she completes your course and how you will provide the learning experiences to assure that those expected outcomes will be achieved. Be sure that you keep this IEP in a convenient place and use it.

The IEP is usually developed through group activities called staffings. Staffings may be held as often as needed and can be used to modify the IEP as the student moves through the program. When a student is about to be mainstreamed into your curriculum, you must become involved in the staffing sessions that will develop the vocational aspects of the IEP. IT IS YOUR RIGHT AND YOUR DUTY, therefore, your being present during the staffings is imperative. The special education personnel can present the student's interests, strengths and limitations. However, only you, the vocational instructor, can relate these to your program. This means that the final statement of the job (DOT) and the task level (short term) objectives are primarily defined by you the vocational instructor.

In Step Three the IEP will first be used to suggest how the curriculum and/or the facilities can be modified to accommodate the special needs population student. Modifying the curriculum means that in most cases special adjustments will have to be made in the student materials and that special instructional strategies will need to be developed. When you say modify the curriculum you are not suggesting that the content be "watered down" - you are proposing alternate ways to teach the proper/required content. REMEMBER! ALL VOCATIONAL EDUCATION PROGRAMS ARE BASED ON REAL JOBS THAT HAVE THEIR OWN TASKS AND STANDARDS. AS FAR AS YOU ARE CONCERNED, YOU HAVE NO POWER TO CHANGE THESE. YOU ALSO CANNOT SUCCESSFULLY CREATE A WHOLE NEW JOB.

Modification of facilities and equipment is a concern when working with the phyically handicapped. Be reminded that by law your school building must already meet requirements of accessibility to all handicapped persons--especially those who are blind or are confined to wheelchairs. Your chief concern is to be sure that your classroom and laboratory will allow the handicapped students to be comfortable and above all to learn. You will also need to make certain modifications that will enable handicapped students to properly and safely use the "tools and equipment of the trade". It is foolish to think that you would have a ready answer for all or any particular one of these physical handicaps--call on the experts. Vocational rehabilitation counselors and other staff have been concentrating on these problems for many years. They should be able to offer a number of positive suggestions. A combination of VR experience and instructor creativity can and has produced outstanding results.

As we think about curriculum modification it would help to review some general learning needs of this population.

> The educationally mentally retarded will constitute a major population now entering vocational education. The key concept to remember in modifying the curriculum for this population is that they require much more detail in order to learn and they require a great deal more practice time. All curriculum modifications for these groups should be made by detailing each task or objective into its smallest parts and by providing for more and more practice.
>
> The hearing and visually impaired can be accommodated by common sense and the use of supporting resource personnel. Neither of these groups reads well or learns from reading as a primary mode. This should be accounted for in modifying the curriculum, i.e., larger print, brail and recordings for the blind and captions on visual materials, seating arrangements, use of notes from a classmate, lower reading level textbooks, oral testing and total communications for the deaf.

The orthopedically hahdicapped usually require attention to facilities and equipment. Beyond that, their learning needs are as varied as those of the normal population. Remember, some of these individuals will actually be highly gifted in their chosen field. Their major needs will be psychological and coping with the school environment.

The disadvantaged are physically and mentally capable of learning, but their background has not allowed them to fully develop the discipline and cognitive skills (i.e., vocabulary, math, etc.) required to master occupational preparation courses. They have also developed an anti-school attitude that complicate many efforts to modify the curriculum for them. Usually their success in the vocational program is contingent on either a good pre-vocational program or a supporting academic program.

Step Four requires that instructional strategies be selected. These strategies may be many and should be varied. They should reflect the best learning technique for a given student and his or her chosen occupation. Some examples of instructional strategies are discussed below.

Teacher demonstration: Simply show the student how the job is to be done in clear distinct steps.

Peer demonstration: This technique allows the instructor to use one of the advanced students to demonstrate a particular task in a step by step fashion. It is a flexible system. For example, you can use peer demonstration to show each task step while you explain them to the students. When working with the mentally retarded, you will never have enough time to demonstrate a task as often as they may need to see it. In such situations, the well prepared advanced student can perform and explain the same demonstration several times.

Shadowing: Shadowing can be used in conjunction with demonstrations. By shadowing, the student is allowed to do exactly what the demonstrator does. This allows the student to learn in a see and do fashion. The student may shadow the instructor, an advanced peer or in some instances the worker on the job.

Job site visits: Job site visits offer the student an opportunity to see the work being done in its natural location. Students can develop a worker identify a realistic view of how the tools, equipment and materials are brought together to produce the product.

Work group or team: By being a part of a work team, the student can learn the various roles in an occupation as having the opportunity to practice specific sets of skills under the tutelage of peers.

Individualized instruction: Appropriately prepared or adjusted individualized instruction is a big help in managing a class that contains a mixture of special needs population students and "norm group" students. Individualized instruction, no matter what the source, will require much developmental input from the instructor. In most all cases, however, the results are worth the effort.

Media: Many of the special needs populations require mediated instruction (i.e., hearing and visually impaired), however, the use of appropriate media enhances learning for all students. Media can range from a line drawing in an instructional module, to a video tape, to posters and charts. It can be instructor made or commercial. All that matters is that it exactly links to the objective.

Project Method: The value in using projects with special needs population students is that they help them mentally and physically unify all the parts into a uniform whole. Because of the detail required for them to learn, they need learning activities that relate all of the parts to the whole. The development of a product through an assigned project is an ideal integrating experience.

Simulations: Simulations meet a variety of instructional needs. One of the more important with special needs population students is providing the opportunity to develop proper safety concepts before actually working with the "live" equipment that could be dangerous to a careless student.

Role playing: Role playing is a part of several other instructional strategies. On its own, it is a very good procedure for developing the attitudes and values required of a successful worker-i.e., a sense of responsibility, the ability to take orders and follow directions, interpersonal skills and so on. It is a way to concentrate on developing good work habits and positive attitudes.

Peer instruction: Like peer demonstrations, peer instruction is able to multiply the instructor's available time. This allows individual students with specific needs to have more assistance. Peer instruction has values beyond expanding time; it is an excellent approach to learning. In almost every situation, both the peer teacher and the peer student profit from the exchange. In operation peer instruction is simply a matter of preparing and allowing one of the advanced students to teach small groups certain segments of a course.

Team teaching: As we have already noted, some special needs populations require a combination of vocational and special education presented in harmony. A team approach is the only way to meet that need. For team teaching to be effective, clarification of student needs (as defined by the IEP) and careful planning will be required.

Peer apprenticeships: The peer apprenticeship is an ideal way to induct the new special needs population student into the curriculum. By serving as the apprentice to an advanced student, the special needs population student can become climatized to the laboratory/shop and can begin to learn the tools, equipment and materials of the program. The shadow technique can also be added to increase hands-on learning.

Assessment and feedback: Student learning can be improved by frequently assessing students' skills and feeding back their strengths and weaknesses. Through a process of positive feedback, the student can be moved gradually from where he or she is to the level of skill required.

These instructional strategies can be used independently or in various combinations. This brief list is meant only to provide you with some suggestions, there are no doubt many other techniques that could be used. The creative instructor will be constantly innovating to meet the needs of particular students.

Implementing the IEP

Step Five is a matter of putting the vocational aspects of the IEP, into operation. The activation of the IEP initiates the student into the vocational education program and allows him or her to progress through the modified curriculum at his or her optium rate. There should be frequent assessment activities that indicate where the student is relative to the IEP objectives. If problems are detected, a staffing should be conducted to re-evaluate the IEP and continue the process in a fashion that is most beneficial to the student.

Step Six will take the student to his or her next logical step of either totally exiting the system or recycling into a continuing education mode. In most cases, the student will do some of both--getting a job and periodically accessing the continuing education component of the educational system to refine existing skills or to broaden his or her capacity.

The ultimate goal of all this effort is not employment-rather it is "successful employment". Successful employment implies that not only is the student placed in a job, but that the student is able to sustain himself or herself in a working environment over an extended period of time.

Evaluation

Evaluation of the student's program is a critical step. Through that process we not only help the current student, but we are able to gather information that will improve our potential to help students with similar difficulties in the future. A well rounded evaluation system should consist of the following activities:

-En-route evaluation (formative) to monitor the student's progress through the program.

-Summative evaluation upon completion of the program to determine job readiness.

-Follow-up after placement to determine if the student is successful on the job.

-Follow-through activities designed to identify any further training needed, which may be indicated by the follow-up procedure.

RESOURCES

In recent years, mainstreaming of special needs population students has been an area of great concern to vocational educators. The overall result of that concern is an abundance of well developed resource materials and a variety of personnel with special skills in working with these groups. In the space allowed by this curriculum guide, it would be impossible to present an adequate set of methods and procedures for solving the problems of students with special needs, but if the vocational eduction administrator and instructor will judiciously use the human and material resources listed here, much of the in-depth information required for the special and unique cases that will occur can be compiled from these sources.

Support Personnel or Systems

As was noted earlier, you the vocational instructor, simply do not have sufficient skills to work with special needs population students alone. There are too many different student problems to ever allow an instructor to deal with them all on a "come as you are" basis. For that reason, you must make yourself aware of the variety of support systems and personnel that are available to you and to the students. A few of these are listed here. These specialists can lead you to others on an as needed basis.

County Health Department - Many of your special needs population students will need some medical and dental assistance. The county health facility is an excellent referral source for these problems.

Special Education - Through local boards of education there are a variety of special education personnel available locally, regionally and from the State Department of Education. The vocational education administrator can obtain assistance from these specialists through the local superintendent's office.

Project SERVE - Project SERVE is a statewide effort to acquire materials and to cultivate expertise in providing vocational education to disadvantaged. Project Serve can be contacted by the area vocational-technical director or the vocational supervisor.

Vocational Rehabilitation - Vocational rehabilitation is a highly developed organization whose major focus is all dimensions (such as: diagnosing, training, job placement and counseling) of the handicapped population. Within that network is a vast pool of expertise. You can contact it through the area vocational rehabilitation counselor who calls on your school or through a designated school official such as the coordinator of student personnel services or Career Development Center personnel.

Office of Student Personnel Services - In the area vocational-technical school, this is the key group as far as students and student needs are concerned. They can provide a variety of services to you and to your students. Many of the contacts with community agencies have already been made by this group-that alone will save the instructor much time.

Career Development Center - Each area vocational-technical school has a Career Development Center designed to meet the very special needs of incoming disadvantaged and handicapped students. The CDC staff is available to assist the instructional staff with a wide range of services for the special needs student populations.

All of the resources and resource personnel listed here are a part of the team. The best results can be obtained by using as many of these people and their support systems as possible from the beginning. In some situations, you will miss a resource in the beginning or the student's needs change. When that occurs do not hesitate to call on the appropriate experts for additional help. As a matter of fact, the rule of thumb that has always been used in the "helping professions" is to go as far as you can, then refer. Do not hesitate to call for help. Most of these service groups are funded to support "your" student. If you do not use them, they fail in their mission and you fail in yours.

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APPENDIX C

Definition of Terms

DEFINITION OF TERMS

1. A/Vs-Audiovisuals - May refer to any picture and/or sound media. (ie. slides, tapes, filmstrips, 16 mm films, etc.)

2. Checkpoint - A student-instructor interface point wherein the instructor may give the student a test, perform a demonstration, or simply provide the student with additional needed information or instructions. Also a checkpoint may be used for motivational purposes.

3. Competency - The ability (knowledge, skills and attitudes) to perform all of a group or cluster of related tasks required to complete a designated activity according to occupational standards. In the educational setting, the statement of a competency includes expected student outcomes in terms of knowledge, skills and attitudes required to complete a designated activity as defined by incumbent workers according to the standards of the work place.

4. Course - A grouping of tasks and competencies which have a common knowledge base or are within a given domain.

5. Criterion-Referenced Measure - An exercise based upon a performance objective, the accomplishment of which measures attainment of that objective.

6. Criterion-Referenced Test - A test designed to measure student competencies based on job or industrial standards.

7. Curriculum Guide - A document containing the objectives, content, organization and structure of an instructional program. It is designed for use by administrators, instructional supervisors and teachers.

8. D.O.T. - Abbreviation for Dictionary of Occupational Titles. Document provides nine digit codes identifying each occupation.

9. Duty - One of the distinct major activities involved in the work performed. A Composition of related tasks.

10. Exit Point - A pre-determined point within an instructional program in which a student may exit with the essential competencies for a specific job. Usually defined in terms of D.O.T. codes and/or O.E. codes.

11. "Hands-On" - Statement implying the student is physically involved in a learning activity.

12. Individualized Instruction (I.I.) - A system of instruction allowing a student to progress at his/her fastest rate.

13. Job - A specific area of specialization within an occupational field consisting of several closely related duties for which a person would expect to receive remuneration. Should be identified by DOT code.

14. Job Sheet - (Or Operations Sheet) - A project of a performance nature. Generally performed by the student in a lab or shop type environment or in a specialized work area.

15. Live Work - Generally refers to items brought into the course area for repair or adjustment. Examples of live work might be automobiles, radios and TV's, air-conditioners, etc. Another form of live work would be patrons visiting the cosmetology department to receive permanents or other services.

16. Master Copies - Original copies of slides, tapes or written materials set aside for the purpose of duplication.

17. Occupational Cluster - A group of occupations sharing a common core of competencies. Georgia's comprehensive high school vocational program is organized around this concept.

18. Occupational Inventory - A listing of tasks to be performed in a particular occupational area, grouped under duty classifications.

19. O.E. - Refers to the U.S. Office of Education. O.E. codes are a classification system (taxonomy) for occupational education programs.

20. Open Entry - Term meaning that a student may enter the program at any time and does not have to wait for quarter or semester breaks.

21. Open Exit - Term meaning that a student may leave a program any time he/she completes occupational objectives.

22. Performance Guide - A series of steps arranged in a sequence which when completed may result in the performance of a task. Also called teaching steps.

23. Performance Objective - A statement in precise, measurable terms of a particular behavior to be exhibited by a learner underspecified conditions. It possesses each of the elements or characteristics specified below:

    a. Condition - The testing situation confronting the learner is clearly specified. This includes equipment provided or withheld, environmental constraints such as temperature, space, etc.

b. Performance - The specific behavior expected of the learner is stated.

c. Standard - The degree of acceptable performance is specified.

24. Performance Test - A test entailing not only the ability to answer questions, but measuring the student ability to operate, manipulate or perform a given task.

25. Program - An organized sequence of courses leading to an occupational objective. A program may contain one or more student exit points as defined by D.O.T. codes.

26. Program Objective - The outcome of a prescribed program of instruction. Usually expressed in terms of the occupation or job for which training is designed. D.O.T. codes are frequently used to identify program objectives or student exit points.

27. Self-Paced - Refers to a student moving through the prescribed training program at the fastest pace at which he/she can meaningfully learn.

28. Sequencing - Putting any set or series of learning activities or tasks into proper order or sequence. Normally arranged from simple to complex within groupings or blocks.

29. Software - Written or printed materials, slides, filmstrips, tapes, etc.

30. Student Manual - A document designed for use by students in a specific instructional program. It contains unit sheets, references, operational procedures, job sheets, etc.

31. Task - The smallest division of work in which a measurable output occurs. A logical and necessary step in the performance of a duty.

32. Task List - A listing of tasks performed by incumbent workers within a domain of interest. An example is a listing of all tasks performed by an automotive mechanic or by a worker in ornamental horticulture.

33. Unit - One "module" training material that generally covers one learning task and programmed on one unit sheet. May cover more than one lesson.

34. Unit Guide - A curriculum guide sheet that lists a task and objective with the instructional activities, instructional materials, evaluation and approximate time required for a student to successfully complete the task.

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35. V'TECS Catalog - A comprehensive collection of performance objectives, performance guides, criterion-referenced measures and related data. Organized by a job structure or career ladder within a domain of interest.

Federal law prohibits discrimination on the basis of race, color or national origin (Title VI of the Civil Rights Act of 1964); sex (Title IX of the Educational Amendments of 1972 and Title II of the Vocational Education Amendments of 1976); or handicap (Section 504 of the Rehabilitation Act of 1973) in educational programs or activities receiving federal financial assistance.

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Title VI - Peyton Williams Jr., Associate Superintendent
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Title IX - Evelyn Rowe and Myra Tolbert, Coordinators
Section 504 - Jane Lee, Coordinator of Special Education

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